SCIENCE LIBRARY
DEC 11 19
UNIV. OF MICH.
LIBRARY

Engineering and Mining Journal

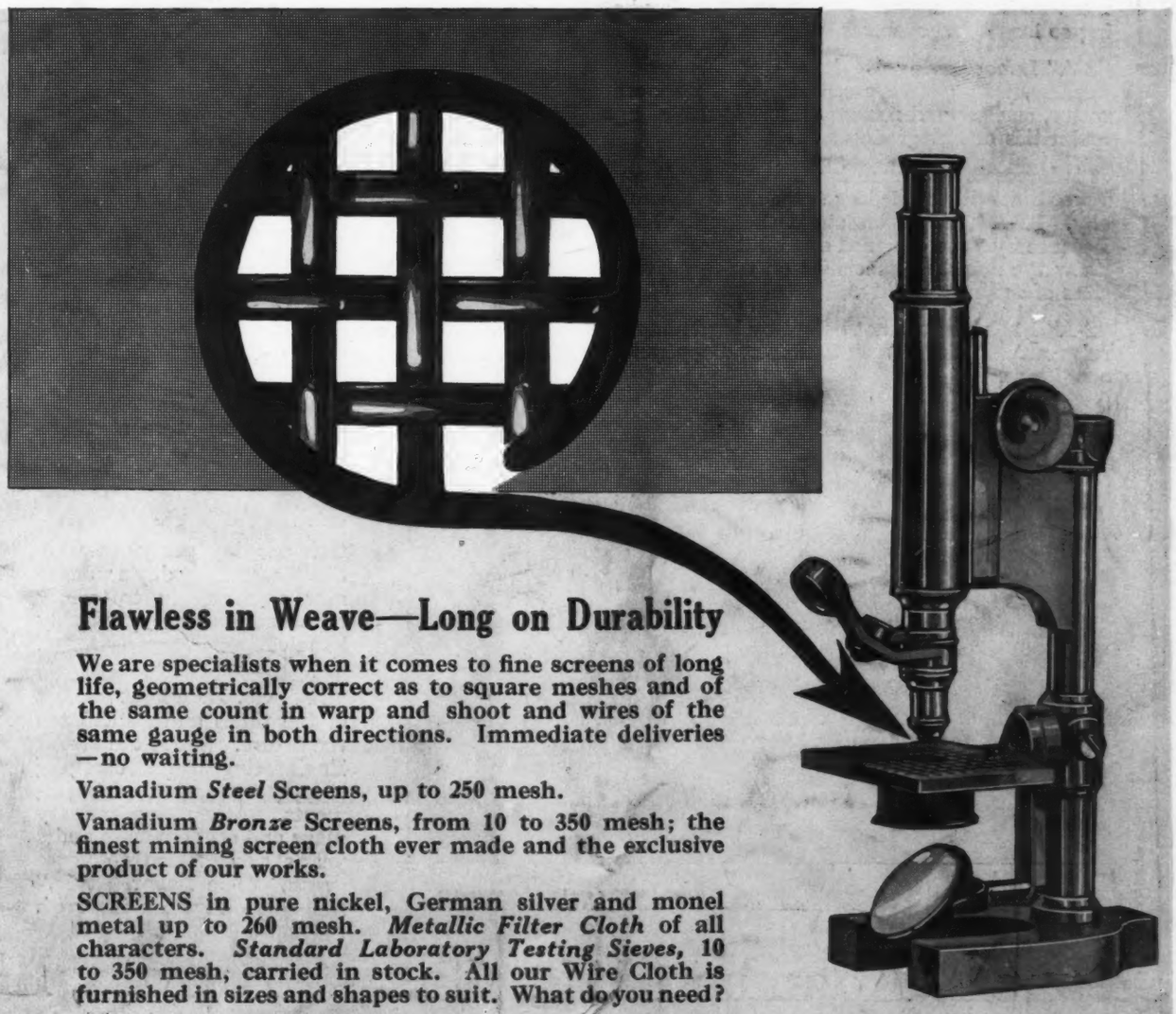
Volume 102, No. 24
Issued Every Saturday
Hill Publishing Company

NEW YORK, DECEMBER 9, 1916

Price, 15 Cents
Contents, First Page
Advertising Index, Last Page

Screens of High Potentiality

10 to 350 Mesh—Ready When You Are



Flawless in Weave—Long on Durability

We are specialists when it comes to fine screens of long life, geometrically correct as to square meshes and of the same count in warp and shoot and wires of the same gauge in both directions. Immediate deliveries—no waiting.

Vanadium *Steel* Screens, up to 250 mesh.

Vanadium *Bronze* Screens, from 10 to 350 mesh; the finest mining screen cloth ever made and the exclusive product of our works.

SCREENS in pure nickel, German silver and monel metal up to 260 mesh. *Metallic Filter Cloth* of all characters. *Standard Laboratory Testing Sieves,* 10 to 350 mesh, carried in stock. All our Wire Cloth is furnished in sizes and shapes to suit. What do you need?

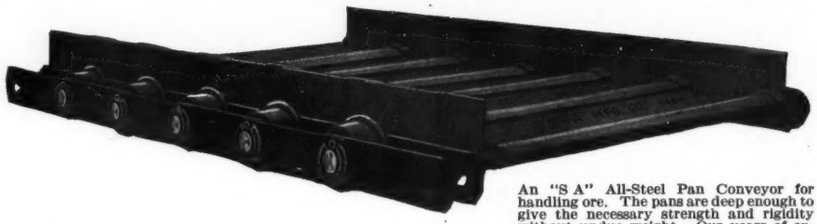
Multi-Metal Separating Screen Company

253 W. 19th Street - - - - New York City

The S-A Page

Published Weekly in the Interests of S-A Conveying Engineering

Big Production Makes Low Grade Ore Profitable—



An "S A" All-Steel Pan Conveyor for handling ore. The pans are deep enough to give the necessary strength and rigidity without undue weight. Our years of experience in designing and executing large contracts of this character have given us a clear understanding of the factors of economy in conveying and our chain construction and our pan designs are the result of this experience.

As much the low cost of handling as the treatment makes this possible—treatment today being so largely mechanical.

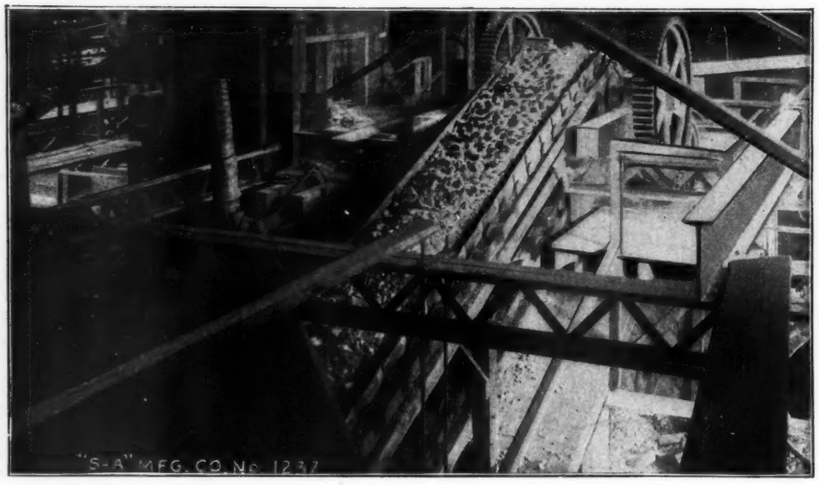
"S-A" Labor Saving Devices—Belt Conveyors, Feeders, Pan Conveyors, etc.—enable concentrator, smelter and mine owners to handle huge quantities of low grade ore profitably.

It is impossible to manufacture a "cheap" conveyor that will handle large capacities economically. "S-A" Conveyors stand the gaff. Why? Because they are designed and built by men who know the field and specialize on this particular class of equipment only.

"S-A" Engineers are not bound by hard and fast rules but adapt their skill to overcoming physical conditions.

Increasing demands for Conveying Machinery

Concentrating and Smelting plants are handling vastly more ore today than five years ago. There is a steadily growing demand for the right kind of conveying machinery—the "S-A" kind.



Installation consists of an "S-A" 36-inch by 104 ft. Steel Pan Conveyor handling ore from the coarse ore bins to the coarse grizzlies. The conveyor runs horizontally the first 60 feet and the remainder is inclined 22 degrees.

Where heretofore 24 to 36-in. conveyors were standard sizes now 42 and 60 in. are in demand.

Formerly five to six thousand tons per day per plant were considered a big day's work—now often fifteen to twenty thousand tons are profitably handled.

"S-A" Co. have kept abreast of the times and anticipated the future. So let the "S-A" Engineering Corps carefully study your particular requirements. Advice, preliminary plans and cost estimate and a year's subscription to house organ, "The Labor Saver," free—no obligation incurred.

Stephens-Adamson Mfg. Co. - Aurora, Ill.

Conveying, Screening

Transmission Machinery

50 Church Street.....New York, N. Y.
First National Bank Bldg.....Chicago, Ill.
H. W. Oliver Bldg.....Pittsburgh, Pa.
Federal Reserve Bank Bldg.....St. Louis, Mo.
First National Bank Bldg., Huntington, W. Va.
503 Dooly Block.....Salt Lake City, Utah
J. W. Gates, District Manager

Branches:

79 Milk St.....Boston, Mass.
Colwell & McMullin, District Managers
824 Dime Bank Bldg.....Detroit, Mich.
310 Stair Bldg.....Toronto, Ont.
E. J. Banfield, Agent

Cable Address.....Saco

So. African Agent....J. MacG. Love & Co., Ltd.
1 and 3 London House, Loveday Street, Johannesburg, So. Africa
Australian Agent.....Arthur Leplastrier & Co.
Circular Quay East, Sydney, Australia
Scandinavian Agent.....C. S. Christensen, A/S
Post Box 85, Kristiania, Norway

Engineering and Mining Journal

VOLUME 102 DECEMBER 9, 1916 NUMBER 24

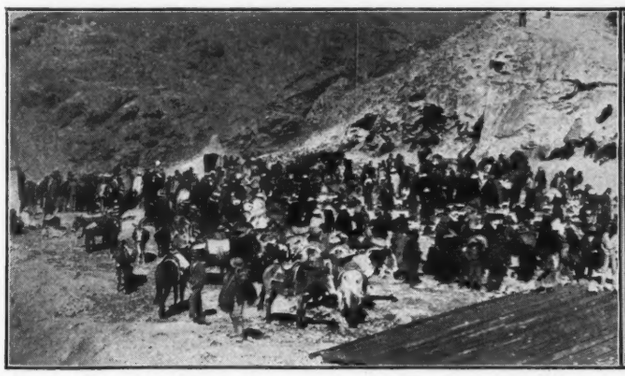
The Mining Industry of Bolivia

By Joseph T. Singewald, Jr.,* and Benjamin LeRoy Miller†

SYNOPSIS—Bolivia has no seacoast. Three-fourths of its area is little known. Remainder high tableland and mountains; cold, dry, barren; present wealth chiefly mineral. Principal values tin and silver. Copper likely to be second. Bismuth important. Also tungsten and antimony. Value of latter in 1915 over $4,000,000. Mineral deposits mainly in eastern range—gold in north, copper near Corocoro, lead and zinc in south. Tin most widely distributed, bismuth often associated, antimony in other veins in vicinity.

There are two countries in South America without seacoast—Bolivia and Paraguay; but the latter has direct connections with the sea by means of navigable rivers, so that Bolivia stands unique as the truly inland country of that continent. As regards climate, topography, natural resources, population and development, Bolivia consists of two distinct parts—the *altiplanicie,* or high plateau and the bordering mountain ranges, and the region to the east of the main Andean chain known as the *yungas* and the country beyond. The latter portion, constituting nearly three-fourths of the total area of about 500,000 sq.mi., is comparatively inaccessible, for the most part little known, much of it inhabited by savage Indian tribes and, though destined to be of great agricultural value in years to come, today produces only relatively small quantities of rubber, coca, cocoa, coffee, etc. It is a region of no present importance in the Bolivian mining industry.

The *altiplanicie* is a high tableland nearly 500 mi. long and over 100 mi. wide with an almost constant altitude of about 12,500 ft. At its northern end, on the boundary between Bolivia and Peru, is Lake Titicaca, the highest body of navigable water in the world. To cross the lake by steamer requires more than twelve hours. This tableland divides the Andes into two distinct chains that bound it on the east and west respectively, the highest peaks rising above it to elevations of 20,000 ft. and more. It is from this part that the mineral production of Bolivia is derived. So highly did the great Peruvian scientist, Raimondi, regard the mineral wealth of this region that he referred to it in most extravagant terms as "a table of silver supported by columns of gold." Climatic and living conditions are most rigorous here. Though lying within the tropics, the climate, on account of the high altitude, is anything but tropical. There is a dry season and a rainy season, but the latter is rainy only in comparison with the former. The total rainfall is small, with the result that low temperature and aridity combined make a very barren and desolate-looking country. In fact, it would be incapable of supporting even its present sparse population if it were not for the wealth derived from its mines; and this portion of Bolivia, which today is really *Bolivia,* would become an almost uninhabited waste if its mineral wealth should reach exhaustion.



PAY DAY AT UNCIA TIN MINE

TYPICAL INDIAN MINERS OF BOLIVIA

That Bolivia is distinctly a mining country is attested by the fact that three-fourths of her revenue from export duties is obtained from those levied on her mineral products. Though it has been subject to considerable fluctuations, particularly in the case of the individual metals, the mineral production of Bolivia has been gradually increasing in recent years. In the accompanying table the output of the various metals is given for the past six years and, for purposes of comparison, the average annual production for the periods 1900 to 1902 and 1910 to 1914 is shown separately.

*Associate in economic geology, Johns Hopkins University, Baltimore, Md.

†Professor of geology, Lehigh University, South Bethlehem, Penn.

This table shows a number of very interesting changes that have taken place in the mining industry of Bolivia during recent years. First of all it shows a great revival of that industry during 1915 after its almost complete paralysis during the latter half of 1914. The extent of this paralysis is indicated not only by the decrease of one-third in the value of the exports of mineral products during 1914 over those of 1913, but even more in the decrease in export duties derived from them, which amounted to more than 50%. In 1915 the value of the exports was nearly thirty million dollars, a figure only a little less than that of 1913 (which represents a maximum) and greater than those of the preceding years. This record was achieved, however, only through unusual production of several of the rarer metals.

Gold mining in Bolivia does not and never has amounted to much, notwithstanding the fact that gold was the objective of the Spaniards and that the search for it led to the discovery and colonization of the West Coast countries. Bolivia has achieved its greatest fame as a silver producer and in the colonial days proved a veritable treasure house for the Spaniards. Potosi, Colquechaca and Oruro literally poured wealth into the Spanish coffers in those days, and the richest of all was Potosi. It is claimed for the Cerro Rico de Potosi, the hill on which the mines are located, that it has furnished more metallic wealth than any other area of equal size in the world, its production being estimated at over $2,000,000,000 in silver, of which more than $200,000,000 went to the Spanish Crown as taxes. Silver mining is rapidly declining in Bolivia, however, and whereas from 1900 to 1902 it contributed nearly 54% of the total metallic production of the country, during the five years 1910-14 it averaged only 6.3% and in 1915 only 3.7%. Not only has there been this great relative decrease, but the absolute decrease was from $5,300,000 in 1900 to $1,092,647 in 1915.

In recent years copper has become the most important of all the metals, and most of the countries that have shown great increases in their mineral production have been those with great copper resources that have been developed. The fact that Bolivia has not become a great copper-producing country accounts for the slow increase in the value of the products of her mines. However, the value of the copper output has shown a constant rise, fairly rapid in the last few years, so that the 1915 production was nearly ten times that of 1900 and from two to three times that of the years immediately preceding 1915. It is hoped that the copper-mining industry may be still further stimulated through the advent of American capital in the Corocoro district, as properties there have been investigated by American engineers. If these properties are acquired, it will mark the first large investment of American capital in a Bolivian mining enterprise and again emphasize the attractiveness of South American copper deposits over deposits of the other metals.

In common with the other South American countries, the lead- and zinc-mining industries have undergone but little development. As was explained in the article on Peruvian mining[1], this does not mean there is a dearth of such deposits, but rather that with high costs and a limited amount of capital the deposits of the more valuable metals are developed first and lead and zinc must await more favorable conditions and times.

Whereas Bolivia was famous in years gone by as a silver producer, her fame as a mining country today rests on her tin-mining industry. Tin has been worked in Bolivia for many years, but the importance of the tin deposits was not realized until the last decade of the past century, when she rapidly became the most important (lode) tin-producing country in the world. By 1900 the value of her tin output had reached 3⅓ million dollars and constituted 37% of all her mineral production. During the five years 1910-14 it averaged over 20 million dollars and constituted 83% of her total mineral production. The maximum output was reached in 1913, when it amounted to over 26 million dollars. After dropping to 16½ millions in 1914, it rose again to over 19 millions in 1915, but owing to a great increase in production of certain of the other metals, it made up only two-thirds of the total value of the 1915 production of metals. As regards the future of Bolivian tin mining, the concensus of opinion seems to be that the maximum has been reached and that new finds will not be more than adequate to compensate the exhaustion of older deposits. The prospects are favorable for the continuance of the present production for some years to come, so that tin mining will continue for a long time to be the most important branch of Bolivian mining; but it is to be expected that its relative prominence will suffer because of the development of other branches.

In addition to the metals mentioned, notable amounts of bismuth, antimony and tungsten are produced. The most important of these has been bismuth, the production of which has undergone an almost constant increase. Furthermore, Bolivia is by far the world's most important producer of bismuth ores. From a little over $100,000 in 1900, the value of the output increased to nearly $1,100,-

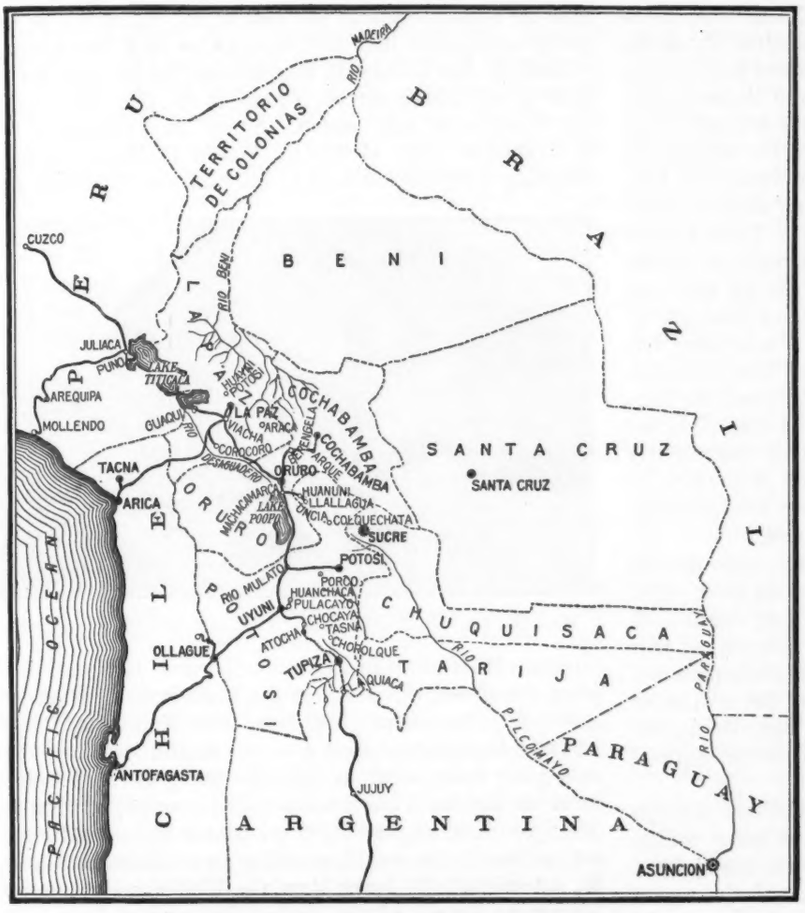
STATISTICS OF BOLIVIAN MINERAL PRODUCTION

Year	Gold		Silver		Copper		Lead		Zinc	
	Dollars	Oz.	Dollars	Oz.	Dollars	Metric Tons	Dollars	Metric Tons	Dollars	Metric Tons
1915	.....	....	1,092,647	2,475,884	.....	.....	.....	.....	.....	.....
1914	118,695	5,790	984,686	2,325,916	1,728,441	3,874	60,489	1,555	54,417	3,755
1913	61,664	3,008	1,083,406	2,613,794	1,278,870	4,020	137,377	1,765	86,829	7,367
1912	51,619	2,518	1,673,393	3,985,177	1,318,745	4,707	83,649	1,075	128,400	8,961
1911	35,985	1,770	1,785,115	4,112,540	555,230	2,950	9,162	343	144,938	9,798
1910	.....	....	2,130,976	4,597,331	695,312	3,212	276	30	169,264	11,897
Annual Average										
1910-14	66,991	3,362	1,531,555	3,526,952	1,115,321	3,753	58,191	954	116,830	8,356
1900-02	39,323	.....	5,070,120	.....	544,376	.....	6,533	...	825	.....

Year	Tin		Bismuth		Antimony		Tungsten		Total Value
	Dollars	Metric Tons	Dollars	Metric Tons	Dollars	Metric Tons	Dollars	Metric Tons	
1915	19,268,862	39,312	1,071,125	568	4,216,050	13,085	293,462	499	29,762,967
1914	16,529,119	37,260	924,899	438	11,913	186	166,654	276	20,579,613
1913	26,375,244	44,595	774,991	390	4,829	62	161,641	283	30,964,857
1912	23,438,987	38,614	783,784	382	8,886	91	202,220	476	27,689,683
1911	20,482,336	37,073	819,518	415	26,622	312	89,956	292	23,948,862
1910	14,399,417	38,548	748,411	311	37,774	525	55,109	210	18,236,539
Annual Average									
1910-14	20,245,021	39,218	810,321	387	18,005	235	135,116	307	24,283,911
1900-02	3,468,606	.....	264,400	...	16,814	...	6,571	...	9,417,568

[1] "Eng. and Min. Journ.," Vol. 101, May 13, 1916, p. 848.

000 in 1915, and in that year barely fell short of the value of the silver production. While no great rise in this industry can be expected, by reason of the limited demand for bismuth and the fact that the Bolivian output supplies such a large part of the market, the indications are that it is well capable of holding its own. Tungsten is a metal subject to great fluctuations in price and consequently the output of tungsten ores fluctuates greatly. With this fact in mind and also that in 1913 an export duty became effective, the figures of production indicate a slow growth of the tungsten-mining industry, with considerable latent possibilities for expansion. The 1915 output was the greatest recorded and the abnormally high prices now prevailing will certainly establish a new high record in 1916. The most phenomenal showing made in the Bolivian mining industry in 1915 was that of antimony. It, likewise, is subject to great fluctuations, due to instability in price, but had never achieved any great importance in Bolivia. From 186 tons in 1914 the high prices prevailing in 1915 were responsible for an increase in that year to 13,085 tons, with a value of $4,216,050, which exceeds that of any other metal except tin. Before the end of the year the demand for ore had already slackened, and the 1916 figures are not likely to equal those for 1915.



THE PRINCIPAL MINING REGIONS OF BOLIVIA

In the past silver and tin have been the principal products of the Bolivian mines, and since 1900 they have constituted jointly 90% of the total value. Owing to the increasing importance of copper mining and more particularly to the unusual activity in that of the rarer metals in 1915, these two metals made up only a little over 70% of the total in that year. In the future silver is likely to yield its place to copper, and tin and copper will be the most important metals produced in Bolivia. The 1915 rank of antimony is only temporary, but there is the possibility that bismuth may outrank silver and compel the latter to drop to fourth place. Opposed to this is the view that silver mining has declined to a large extent, on account of neglect due to the greater attractiveness of tin mining during the development of that industry, and that from now on attention will revert to silver mining and greater activity may be anticipated in it. There is no basis for expecting a great increase in the output of the other metals, so that the increase in Bolivia's metal output will be determined largely by the course of copper mining in that country. The mineral deposits of Bolivia are found principally in the eastern range of the Andes from Lake Titicaca to the Argentine border, a belt having a length of about 500 mi. There are a few isolated groups of hills with the *altiplanicie*, geologically a part of that range, that are likewise mineralized; as for example, the Oruro hills. The western range, which lies principally in Chile, is characterized by recent volcanic activity and has not been so generally mineralized. Its most important deposits are the nonmetallic deposits of sulphur and borax that lie chiefly in Chile. Extending longitudinally across the *altiplanicie* is the copper belt in which Corocoro lies. Consequently most of the mining districts of Bolivia are found within a belt about 100 mi. wide on the east side of the railroad that traverses the *altiplanicie* along its eastern edge. Deposits of all the metals are nearly coextensive with the main eastern range of the Andes, but those of commercial importance seem to be grouped about certain more or less well-defined centers. Gold mining is confined almost entirely to the department of La Paz. The Chuquialguillo placer near La Paz, for a time an important producer, is idle, and the gold output has been derived chiefly from the Olla de Oro and Incaoro mines (both owned by American capital), which lie to the east and north of La Paz respectively. Almost the entire silver production comes from the districts of Huanchaca, Oruro and Potosi; but the province of Sud Chichas, in the southern part of the department of Potosi, will soon be an important producer. At Chocaya and other neighboring places, tin ores carrying good silver values are being mined and the silver is to be recovered by lixiviation.

Nine-tenths of the Bolivian copper production comes from the Corocoro district, which lies outside of the main mineralized belt of the eastern Andes, on the *altiplanicie* itself, within a belt of copper deposits that extends more or less continuously the entire length of the high plateau. The remainder of the output comes as a byproduct from

the ores of the Compañia Huanchaca de Bolivia at Pulacayo, from those of the Aramayo Francke Mines, Ltd., to the south of Pulacayo, and from Oruro and Potosi.

The lead ores are derived almost entirely from southern Bolivia in the region about La Quiaca. They are packed in on llamas and mules to the latter place and exported via Argentina. In 1913 over three-fourths of the lead ores went out by this route. The zinc ores come entirely from the Pulacayo mines. As stated, the actual occurrence of lead and zinc ores is far more widespread than is indicated by these few producing points.

The tin deposits are the most widely distributed of the Bolivian mineral deposits and are being worked throughout the extent of the Cordillera Real, or eastern range. Nevertheless ten important centers of production account for nine-tenths of the total production, and these from north to south are Araca, Oruro, Machacamarca, Huanuni, Llallagua, Uncia, Potosi, Sala Sala, Chocaya and Chorolque. Simon I. Patiño's mines at Uncia and Huanuni produce nearly two-fifths of the total. The Uncia and Llallagua mines, which work different parts of the same group of veins on the same mountain, together produce over two-fifths of the total; while the Uncia mines alone produce about 30% of the total Bolivian tin output. Three-fourths of the production comes from the department of Potosi.

The bismuth ores are associated with the tin ores, but are not so widely distributed. Important amounts of bismuthinite are found in certain of the Uncia veins, but the chief producing mines are those of the Aramayo Francke Co., Ltd., at Tasna and Chorolque, and the Carmen mine at Huayni Potosi (north of La Paz), worked by the Huet brothers. The latter mine is particularly noteworthy on account of the abundant occurrence of native bismuth. Otherwise the prevailing bismuth mineral is the sulphide of bismuth, bismuthinite.

The antimony ores are also found in the same general region as the tin ores, but as a rule not in the same veins. The veins are usually narrow, but the filling consists almost entirely of stibnite with very little gangue; so that it is comparatively easy to sort out a high-grade material. In the "boom" of the past year the principal centers of production were the Chuquiutu district, near Uncia, the country about Porco and that around and to the south of Atocha.

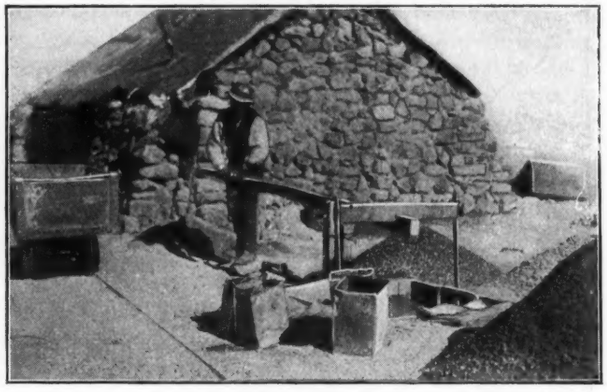
Tungsten ores are likewise widely distributed through the tin region and have been produced at many points. At present the chief producing regions are the Quimza Cruz district, northwest of Cochabamba, and the region between Uyuni and Chorolque in which Sala Sala is the most important center.

This review of the distribution of the mineral deposits of Bolivia shows that from the standpoint of present productivity the department of Potosi is the most important and that it produces over half of each of the metals considered with the exception of gold and copper, for which that position is held by the department of La Paz.

Mining Conditions in Bolivia

The greatest difficulties encountered in mining in Bolivia are high transportation costs, lack of fuel and scarcity of labor; in which respects it does not differ from other West Coast countries of South America.

While transportation problems are not easy in Bolivia, they are by no means so difficult as in Peru, and the mining industry is far better served by railroads in the former country than in the latter. Bolivia is fortunate in having its mineralized country paralleled by the great high plateau along and across which the construction of railroads is comparatively easy. The completion of the Antofagasta & Bolivia R.R. to Oruro over 25 years ago and the extension of the Southern Railway of Peru via Lake Titicaca to La Paz 15 years ago made it unecessary to pack everything to and from the coast on animals. It seems remarkable that the former road was not extended to Viacha to connect with the latter until as late as 1908. This extension gave La Paz, the virtual capital[2] of the country, two outlets to the sea by modern transportation. The completion of the Arica-La Paz line in May, 1913, gave a third and more direct outlet. There is now consequently a line running the entire length of the *altiplanicie* along its eastern edge, from which branch lines are being built into the mineral belt to the east of it. At Oruro is the partly completed line to Cochabamba that has already opened up the Berengela district and made more accessible to rail transportation a number of other tin-producing districts of that region. From Machacamarca, the next station south of Oruro, Simon I. Patiño is constructing a private railroad to his mines at Huanuni and



MARITATA, OR HAND JIG, USED AT BOLIVIAN MINE

Uncia. It is now in operation beyond Huanuni and when completed will also put the Llallagua mines on the railroad. The branch line from Rio Mulato to Potosi has now been in operation four years, and its course lies only three miles north of the old mining town of Porco, in which district it has made possible a revival of mining. The line has a length of 108 mi. and is the second highest railroad in the world, reaching an elevation of 15,814 ft., or only 51 ft. lower than the highest point on the Morococha branch of the Central Railroad of Peru. At Uyuni the Compañia Huanchaca de Bolivia has a line 25 mi. long to its mines at Pulacayo, and a line is under construction to La Quiaca on the Argentine border to connect with the Argentine railroads. It is now in operation as far as Atocha, a distance of 51 mi. out of a total of nearly 200 mi. This line runs through a mineralized area that was of considerable importance formerly, and the introduction of modern transportation facilities will no doubt again make it an important contributor to the mineral production of the country. The completion of this line will also provide a second transcontinental railroad in South America, that will have an advantage over the present line (between Buenos Aires and Valparaiso) of being able to operate throughout the year. The previously mentioned Arica-La Paz line has solved the transporta-

[2]The City of Sucre is the nominal capital, but the congress meets at La Paz and the president resides there.—Editor.

tion problem for the Corocoro district. There are now 1,000 mi. of railroad in operation in Bolivia. There are still many ore deposits lying dormant in the country, owing to lack of transportation facilities, but compared with conditions that existed only a few years ago and that still exist in other South American countries, mine operators in Bolivia have much for which to be thankful.

With increased transportation facilities the fuel situation is not nearly so acute as it was. Accustomed as we are to an abundance of coal and wood, it is difficult to realize what a problem this has been. The most important native fuel is the *taquia,* the droppings of the llamas. Incredible quantities are used both as domestic fuel and to run mining machinery and smelters. One of the companies at Corocoro alone consumes annually 10,000 tons of *taquia,* having a value of $4 per ton. Locally *yareta* is found in sufficient quantity to be of importance as a fuel. It is a plant that grows in large clusters of woody, resinous fibers adhering to the rocks at high altitudes and has the appearance of large clumps of moss. In addition, at a few points there are sufficiently large accumulations of peat to make it an available fuel. Fuels other than these must be imported, and if their price is not to be prohibitive at the points of consumption, relatively cheap transportation must be provided. The rapid extension of the railroads of Bolivia in recent years has made it possible to use increasing quantities of imported fuel, and especially oil. Diesel engines are being introduced very extensively, as they furnish the easiest solution of the power problem at present.

The labor question in Bolivia is a difficult one. The high plateau lies at an elevation of over 12,000 ft., and the mines are in the hills and mountains that rise above it up to elevations of as much as 18,000 ft. Most of the mines lie between 14,000 and 16,000 ft. At such elevations it is impossible to use imported labor, as it cannot endure the strain of continuous manual exertion, and it is necessary to depend on the native Indian stock. The supply of this is limited, and consequently in the regions where there has been the greatest development of mining operations difficulty is experienced in obtaining sufficient labor. The Indians are a primitive people, and their methods of work are equally primitive, with the result that their efficiency is not high. The obvious and probably the only method to meet the growing demand for labor attendant on the increasing development of the country is to increase the efficiency of the labor available. A more enlightened and altruistic attitude on the part of the Spanish inhabitants of the country might also be effective in considerably augmenting their numbers. Efforts along the lines of social, moral and sanitary uplift, instead of the purely materialistic policy of exploitation of these people, might yield such results and prove more profitable in the long run. The present status of the Andean Indians was described in some detail in a previous article[3] and need not be discussed again.

Travel and Living Conditions

Travel in Bolivia cannot in any sense be called a pleasure from the standpoint of comfort and conveniences in comparison with our own standards. On the other hand, conditions are far from unendurable, and anyone who has a real purpose in traveling in Bolivia need not hesitate to do so. The *nocturnos,* or through trains, have modern sleeping cars and a really good dining-car service furnishing for 3 bolivianos (about $1 gold) table d'hote meals) that are better than the meals one can get at any hotel in the country. The most uncomfortable feature of the trains is that they are not heated. During the day, when the sun is shining, the cars are quite comfortable, but early in the morning and in the evening it is very cold in the coaches, and on the *nocturnos* the water often freezes to such an extent that one cannot wash in the morning. The railroad fares range from about 2½ to 5c. per mi., and 50 kg. of baggage is carried free. On the principal lines there are about three trains a week and on the branch lines usually not more than one. As soon as one is called upon to leave the lines of railroad transportation, though he can in a few instances depend upon stage lines, for the most part he must travel on muleback. Owing to the lack of forage and grain, mules are expensive and often it is impossible to secure animals at all.

There is no first-class hotel in the entire country. Even in La Paz, the *de facto* capital and principal city, the best hotel makes no effort to furnish a hot bath after 6 p.m., and what is called hot water before that hour is merely water that does not feel cold to the touch. A source of considerable discomfort is the lack of heating apparatus, so that only rooms on the sunny side of the house are warm during the day and no room is comfortable to sit in at night. We were repeatedly driven to bed immediately after supper in order to get warm. Fresh milk and fresh butter are almost unknown. In the northern part of the country, at La Paz and Oruro, one can get Peruvian butter shipped in from Arequipa; elsewhere canned Danish butter is used. The meats are not particularly good and are nearly always spoiled for some *yanquis* by the liberal flavoring with *aji,* a variety of pepper. One can nearly always get good bread, so that even under the worst conditions he can satisfy his hunger. In La Paz one pays about $2.50 per day for room and meals, and in the rest of the country from $1.50 to $2.

Taking into consideration the resources of the land, its stage of development and the amount of travel, one must in all fairness say that railroad and hotel accommodations are all that one can reasonably demand. Except for the lack of heat, the houses of the better classes are comfortable and their food supply varied and good, so that if called upon to remain at a given place any length of time, one can make oneself comfortable.

[3]"Eng. and Min. Journ.," Vol. 101, May 13, 1916, p. 849.

New South Wales Tin Production*

The value of the tin production of New South Wales in 1915 was £266,780, compared with £267,130 in 1914. Of this amount the various dredging plants produced 1,164 tons valued at £116,549, a decrease of 41 tons and £2,618 in value from the record of the previous year. This brings the total stream tin recovered by the dredges since 1900 up to 16,375 tons valued at £1,748,742.

The output in the Emmaville division was 1,045 tons valued at £105,104; in the Tingha division, 662 tons valued at £64,076; in the Wilson's Downfall division, 139 tons valued at £13,303; in the Glen Innes division, 103 tons valued at £10,043; in the Torrington division 59 tons valued at £5,310; on the Fidlethan field, ore and concentrates valued at £53,771.

*Excerpt from Annual Report of the Department of Mines, New South Wales, for the year 1915.

The Kimberlite of Brazil*

Some correspondence from the United States has reached this office concerning my report of Aug. 8, on "The Diamond Fields of Brazil" (appearing in *Commerce Reports*, No. 212, of Sept. 9, 1916) in which mention was made of the presence in this country of the eruptive masses commonly known as "pipes" of kimberlite, or diamond matrix.

The subject is of intense interest, naturally enough, to geologists as well as to diamond miners generally, and a report upon as much of its history as is known at present may be interesting.

Brazilian diamond mining, as mentioned in my report above cited, has traditionally been placer mining. There may have existed here the vague dream that all placer miners indulge in, in all countries, of finding the mother lode "farther up," but these never appeared to attract attention until the arrival in this country, in 1909, of Samuel Draper, the geologist, well known as the discoverer of the "Premier" mine in South Africa and an acknowledged expert among geologists on diamond prospects.

It should be remembered that the first orderly attempts at systematizing the geological work of Brazil date back to the early 70's when, the country still being under the empire, Messrs. Branner, Hartt and Derby first visited it and described certain portions of it. Of these three geologists only Dr. Orville E. Derby remained in Brazil, becoming first, geologist to the state of São Paulo, and then later, through the efforts of the famous Baron de Rio Branco, being attached to the Geological Section of the Federal Government's Department of Agriculture and Industry.

It was to the late Dr. Derby that his friend and colleague, Draper, first addressed himself when, in 1909, he had completed certain examinations of the Aguas Sujas mine at Baggagem, in the state of Minas Geraes. It is a placer mine—an ancient conglomerate lying high above the present river levels—and Mr. Draper believed that he had found there traces of a broken-down "pipe" of kimberlite.

Dr. Derby was busied with other things at the time, and not until 1913 did he begin seriously to direct his attention to the matter, when Mr. Draper reopened the question with him and a petrographer in the service of the Brazilian government, a German named Everard Riemann, at Tiros, a village in the state of Minas Geraes on a branch of the São Francisco River, in the Serra de Matta da Corda, where he believed again to have found evidence of kimberlite.

In 1914 Dr. Derby, who was at the head of the geological work of Brazil, sent Riemann, the petrographer, and Horace Williams, a geologist, together on an expedition to Tiros and beyond to investigate. They returned, bringing with them good, but still not quite conclusive evidence, substantiating and adding to Mr. Draper's prognostications.

In 1915 Mr. Riemann went on a mission, alone, to Tiros and beyond that point. He reported, it is said, the discovery of at least five "pipes" of kimberlite. Toward the close of the year 1915 Dr. Derby made an official report to the Brazilian government of these conditions, which I believe was printed in the *Imparcial* newspaper of Rio de Janeiro. At that time, Mr. Draper has stated to me that Dr. Derby—whose kindliness and fairness to all his associates had become proverbial here—also sent him a letter acknowledging that to him was due full credit for the discoveries. I am in hope that by another mail I may have obtained for transmission to the department a copy of the letter in question, which has been promised me.

The Brazilian government, as stated in my report of Aug. 8, has given serious consideration to this matter and is awaiting the reports of a geologist and a petrographer who are studying conditions at present.

Two months ago Mr. Draper returned to Brazil and will now, I am told, continue his investigations of this subject. Their result, as may naturally be supposed with a man of his acknowledged ability, will be awaited with intense interest here.

*Communication from Alfred L. Moreau Gottschalk, consul general at Rio de Janeiro, Brazil, to the U. S. Department of Commerce, Oct. 24, 1916.

Analyses and Assays of Rocks

The question is frequently asked of the United States Geological Survey, according to a statement in the Bulletin, November, 1916, "What is the difference between an assay, an analysis, and an expert examination of a specimen of rock or mineral—such a specimen as may be sent to the Geological Survey by anyone who has found or thinks he has found a valuable mineral?" Most of the Survey's correspondents ask for assays of their specimens, others ask for analyses, and few appear to distinguish between the two. The Geological Survey can make neither an assay nor an analysis for private parties; it can, however, make a visual inspection of a specimen, or it can make a simple chemical test to determine whether the specimen contains a commercial amount of some valuable mineral, such as potash. Of the specimens submitted to the Survey 99% are found to be commercially valueless. Such an inspection, or test, however, is widely different from an analysis. A complete analysis of a rock that is composed of many different minerals may require the more or less continual attention of a chemist for a month or six weeks, and such work is done by the Survey only in connection with its own scientific investigations. An assay, an the other hand, is usually a fire test made to determine the exact metal content of an ore specimen. The Geological Survey makes no assays for private parties.

The Survey has recently reprinted its Bulletin 422, by W. F. Hillebrand, entitled "The Analysis of Silicate and Carbonate Rocks." This is a revision of Bulletin 305, which was so highly valued in Germany that it was there translated and republished. It contains a detailed description of the analytical methods employed in the laboratory of the United States Geological Survey and represents the experience gained in the analysis of more than a thousand igneous rocks alone. These analyses have been carried to a degree of completeness previously unknown, by methods that have been carefully tested and proved, some of them devised in the Survey.

A copy of Bulletin No. 422 may be obtained on application to the Director of the Geological Survey, Washington, D. C.

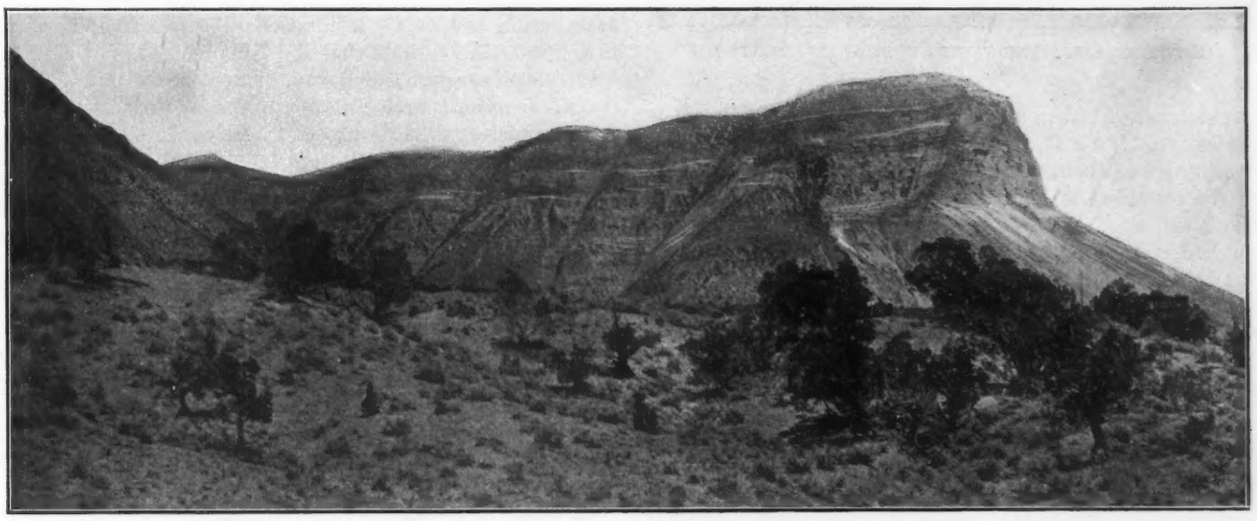
Molybdenite Occurs in Rhodesia in several places, but so far has been found nowhere in commercial quantities. Recently, however, a deposit which is believed to be of considerable size has been discovered near the Umfuli River. It is now being explored.

The Bituminous-Shale Industry in Northwestern Colorado

By G. R. De Beque*

SYNOPSIS—The oil-shale area is about 20x50 mi. in extent. Deposits are being exploited and transportation equipment being installed. A sample of shale showed yield of 51.8 gal. of oil and 30.9 lb. of ammonium sulphate per ton of rock. Recent tests indicate the possibility of producing at a low cost oils high in cresols and phenols, suitable for use in flotation processes.

An examination of the bituminous shales, or oil shales, of northwestern Colorado was conducted by the United States Geological Survey in 1913. The result of the examination, necessarily of a preliminary character, served to show that the Colorado shales are much more extensive in area and thickness and richer in oil content than the bituminous shales of Scotland and France, which have been worked continuously for the last 60 or 70 years.



ERODED MESA, CHARACTERISTIC OF NORTHWESTERN COLORADO, WITH OIL-SHALE OUTCROPPING NEAR SUMMIT OF MOUNTAIN

More detailed experiments have been conducted recently by private individuals with the result that a number of valuable byproducts have been discovered through the fractionating of the distillate derived from the shale. Among the various products so far found are a number of aniline dyes, ichthyol (a valuable drug), ammonium sulphate, paraffin wax, flotation oils, phenol and gasoline; besides various materials which are found in the residue after distillation and which are utilized in the manufacture of insulating and roofing material and paints.

The Colorado oil-shale area extends westward from Rifle for a distance of 50 mi. and northward from De Beque for 20 mi. The town of De Beque, which is on the Denver & Rio Grande R.R., is on the south-central edge of the oil-shale zone, and it is in the territory contiguous to this place that the industry is being developed. In recent geologic time the surface of the area in this particular section was a high plain extending from the plateau on the north to Battlement Mesa on the south. Through this plateau Grand River has cut a valley to a depth of 3,600 ft., and the shale beds are exposed along a range of hills that rise to the north above the river valley. The igneous basement in western Colorado is covered by a series of formations, several thousand feet thick, which belong to the Paleozoic, Mesozoic and Cenozoic ages. The rocks of the Tertiary period were among the last to be deposited, and these are classified, in part, as the Bridger, Green River and Wasatch formations. The oil-bearing shales that outcrop in this section belong to the Green River formation and are the only ones that have received attention.

The Green River formation is characterized by the even bedding of the strata, by the presence of bitumen in some of the shale and by the calcareous character of the sandstone and oölite. Fish scales are common in this formation, and well-preserved insects and fossil turtles have been found. The bituminous shales occur in lenticular beds from a few inches to 80 ft. thick. A continuous exposure of several thousand feet generally reveals no marked variability in thickness.

The shale, which has been pronounced as wurtzelite—a hydrocarbon similar to albertite—has a specific gravity of 1.60, is light to dark brown in color, has a velvety luster and, when scratched, gives a light-brown streak. It is very tough, being split along the bedding planes with difficulty and strongly resists breaking across stratification. A sliver, when ignited, burns with a sooty smoke and gives an odor of burning petroleum. When large pieces are ignited in a pile, they soften and become plastic. In the richer shale there is an irregularity of lamination which gives it a peculiar curly structure, and the name of "curly shale" has been applied to this particular class of material because of its appearance.

*De Beque, Mesa County, Colo.

Chemical and microscopical examinations of the shale show an intimate mixture of calcite and fine-grained quartz embedded in a mass of vegetable débris consisting of cells, spores, wood and pollen grains. A partial analysis of the oil-shale gives the following result: Volatile 36.14%, sulphur 0.94%, nitrogen 0.59%, ash (mineral matter) 61.85% and water 0.48%. This shale contains 51.8 gal. of oil and 30.9 lb. of ammonium sulphate per ton of rock. The oil has a specific gravity of 0.91642. It is dark brown to black in color and has a pungent odor.

One of the large shale beds is being opened on Kimball Creek, 30 mi. from De Beque. This deposit outcrops near

OUTCROP SHOWING "CURLY SHALE," NEAR DE BEQUE, COLO.

the summit of the range at an altitude of 8,000 ft. It is approximately 80 ft. in thickness and is covered with an overburden of about 60 ft. of rock and dirt. The intention of the operators is to remove the overburden and extract the shale rock in open quarries. The pillar-and-stall method of mining will probably be employed in working the lower shale beds in cases where they are more than 4 ft. thick. Deposits under 4 ft. in thickness will be worked by the longwall system. The company is constructing an aërial tramway to convey the shale to the foot of the mountain, a distance of about ¼ mi., where it

OIL SHALE OUTCROP NEAR SUMMIT OF RANGE ON KIMBALL CREEK, NEAR DE BEQUE, COLO.

will be loaded into motor trucks and transported to the railroad at De Beque; from which point it will be shipped to Eastern chemical works for treatment.

The exploitation of the immense oil-shale deposits of Colorado opens a new field of industry in the United States, and that business promises to become one of great importance in the near future. As experimental work advances, additional byproducts of value undoubtedly will be discovered. Tests are being conducted at De Beque with a view to producing oils high in cresols and phenols, so that Western mining companies may be supplied with flotation oils at low costs. Such oils have already been produced locally, in quantities sufficient for laboratory experiments, and the intention is to enlarge the plant to meet market requirements.

Chronology of Flotation

By William Motherwell*

The chronology of flotation patents has been fully dealt with in T. J. Hoover's book and credit given to the different inventors. This article is intended to deal only with the commercial application of flotation—successful and otherwise. It is, of course, difficult for anyone to make a complete list of working-scale plants all over the world, especially as so much secrecy has been observed, so that there are probably many omissions. Any criticism or amendments will be cheerfully received, to the end that a true record of the work done in different countries may be obtained.

As the Murex magnetic is not strictly a flotation process, I have not included plants using that system. The Cattermole has been included, as it was partly a granulation and partly a flotation process. Incidentally, it is interesting to note that the Elmore, Potter, Delprat, Minerals Separation, de Bavay, Murex, Horwood, Lyster, Owen, Bradford and Callow processes, like the MacArthur-Forrest cyanide process, were made commercially successful by Britishers, mostly Australians, and the Macquisten flotation process was invented by a Scotchman and first applied commercially in the United States by a Scotch mining company, the Glasgow & Western.

First Application of Flotation

Hoover estimates that up to the end of 1913, 11,000,000 tons of material had been treated by flotation at Broken Hill alone. It is said that feathers dipped in pitch were used to recover gold as long ago as 400 B. C., but whether used on a commercial scale history does not relate, and perhaps this was not exactly a "flotation process." According to the Hoover book the Everson process was tried on a fairly large scale (whatever that may be) at Baker City, Ore., in 1889, and also near Denver in the same year.

It is stated in a letter in the *Journal* of Apr. 14, 1906, that flotation was successfully used in treating the telluride ores of Boulder County, Colo., about 20 years before that date, by Albion M. Rouse. The process seems to have resembled the Potter process in that acid and not oil was used. I think this will be news to most of the present-day Cripple Creek metallurgists who are struggling with the problem.

In the *Journal* of Aug. 12, 1905, an interesting fact is mentioned which is probably not generally known. The reference is given in the bibliography to Hoover's book, but I do not think it is mentioned in the book itself. This is a statement that the old Elmore thick-oil process had been experimented with for the recovery of diamonds at the Premier mine in the Transvaal and proved so successful that a plant with a capacity of 800 tons per day would be built. Can anyone say whether it was success-

*Metallurgist, Salt Lake City, Utah.

ful? This, of course, is a different process from the grease tables used at Kimberley.

It will be seen that I have only brought the list down to the end of 1914. The number of companies that did not wake up until 1915 is so large that I am afraid the editor could not spare the space to specify them.

Name and Location of Mine	Daily Tonnage	Metals in Ore or Tailings	Process
1896			
Glasdir mine, near Dolgelly, Merioneth, Wales	?	Au, Ag, Cu	Robson & Crowder
1898			
Glasdir mine, near Dolgelly, Merioneth, Wales	?	Au, Ag, Cu	Old Elmore
Date Unknown*			
Boston Cons. Co., Utah, U.S.A.		Cu	Old Elmore
Cape Copper Co., Namaqualand		Cu	Old Elmore
Namaqua Copper Co., Namaqualand		Cu	Old Elmore
Mammoth Mining Co., Utah, U.S.A.			Old Elmore
1901			
Detroit Copper Co. (?) Morenci, Ariz., U.S.A.	80	Cu	Old Elmore
Sygun mine, Wales	100	Cu	Old Elmore
St. David's mine, near Dolgelly, Merioneth, Wales	...	Au, Cu	Old Elmore
Tywarnhaile mine (date uncertain) Cornwall, England	...	Cu	Old Elmore
1902			
Santa Barbara mine, Yauli, Peru	100	Ag, Zn	Van Meter & Boss
Alpinina mill, Yauli, Peru	100	Ag, Zn	Van Meter & Boss
1903			
Broken Hill Proprietary, Broken Hill, N.S.W., Australia	500	Pb, Zn, Ag	Delprat
Broken Hill Block 14, Broken Hill, N.S.W., Australia	?	Pb, Zn, Ag	Potter
1904			
Le Roi mine, British Columbia, Canada	?	Cu	Old Elmore
Lake View Consols, Kalgoorlie, Western Australia		Au	Old Elmore
1905			
Sulphide Corporation, Broken Hill, N.S.W., Australia	100	Pb, Zn, Ag	Cattermole
Sulphide Corporation, Broken Hill (old mill), Australia	300	Pb, Zn, Ag	Minerals Separation
Zinc Corporation, Broken Hill, N. S. W., Australia	300	Pb, Zn, Ag	Potter
De Bavay Treatment Co., Broken Hill (1st mill), Australia	10 to 400	Pb, Zn, Ag	Original de Bavay
1906			
Sulphide Corporation, Broken Hill, N.S.W. (new mill), Australia	500	Pb, Zn, Ag	Minerals Separation
Adelaide Reduction Works, Goldconda, Nevada, U.S.A.	125	Cu	Macquisten
(?) Marion. Kentucky, U.S.A.	?	?	Sanders
Kelly mine, Magdalena, New Mexico, U.S.A.	100	?	Sanders
1907			
Zinc Corporation. Broken Hill, N.S.W. (2nd mill), Australia	300	Zn, Pb, Ag	Minerals Separation
Minerals Separation, Ltd., Broken Hill, N.S.W., Australia	900	Zn, Pb, Ag	Minerals Separation
At Block 10 mine, Broken Hill, Australia	?	Zn, Pb, Ag	Gillies
At Block 10 mine, Broken Hill, N.S.W., Australia	?	Zn, Pb, Ag	Minerals Separation
Pinnacles mine, near Broken Hill, Australia	?	Zn, Pb, Ag	Elmore Vacuum
Sulphide Corporation and Minerals Separation, Broken Hill, N.S.W. (Slime), Australia	100	Zn, Pb, Ag	Minerals Separation
Dolcoath mine, Cornwall, England	40	Cu, Sn	Elmore Vacuum
Ore Concentration Syndicate, Broken Hill, N.S.W., Australia	40	Zn, Pb, Ag	Elmore Vacuum
Tywarnhaile mine, Cornwall, England	40	Cu	Elmore Vacuum
Date Unknown			
Ramsley mine, Devonshire, England	40	Cu	Elmore Vacuum
Avino mine, Durango, Mexico	...		Elmore Vacuum
Caucasus Copper mine, Dzansul, Russia	...	Cu	Elmore Vacuum
Telemarken mine, Norway	120	Cu	Elmore Vacuum
Saxberget mine, Sweden	...	Zn, Pb, Ag	Elmore Vacuum
Garpensberg mine, Sweden	80	Cu	Elmore Vacuum
Traag mine, Norway	40	Pb, Zn	Elmore Vacuum
Hadeland mine, Norway	100	Zn	Elmore Vacuum
Edmundian mine, Rhodesia	80	Cu	Elmore Vacuum
Glasdir mine, Dolgelly, Wales	40	Cu, Ag, Au	Elmore Vacuum
1908			
Zinc Corporation, Broken Hill, N.S.W., (third mill) Australia	700	Zn, Pb, Ag	Elmore Vacuum
Pinnacles mine, Broken Hill, N.S.W. (third mill), Australia	160	Zn, Pb, Ag	Minerals Separation
Cobar Gold mines, Cobar, N.S.W., Australia	120	Au, Cu	Elmore Vacuum
New Ravenswood Gold mine, Queensland, Australia	...	Au, Cu, Zn, Pb	Elmore Vacuum
Saxberget mine, Sweden	...	Zn, Pb, Ag	Minerals Separation
John Moffatt, Wolfram, Queensland, Australia	...	Mo	Wood (?)
1909			
San Francisco del Oro, Chihuahua, Mexico	100	Au, Ag, Pb, Zn	(?)
1910			
British Broken Hill mine, Broken Hill, Australia	400	Zn, Pb, Ag	Elmore Vacuum
British Broken Hill, Broken Hill, N.S.W., Australia		Zn, Pb, Ag	Minerals Separation
Gt. Fitsroy mine, Rockhampton, Queensland, Australia	250	Au, Cu	Minerals Separation
New Einasleigh Copper mine, Queensland, Australia	120	Cu	Elmore Vacuum
Sulitjelma Copper mine, Norway.	600	Cu	Elmore Vacuum
Amalgamated Zinc (de Bavay), Broken Hill, Australia	1,600	Zn, Pb, Ag	Improved de Bavay
Lancefield Gold mine, Laverton, Western Australia	?	Au	Minerals Separation
1911			
Federal Mining & Smelting Co., Mullan, Idaho, U.S.A.	150	Pb, Zn	Macquisten
Butte & Superior, Butte, Mont., U.S.A.	500	Zn, Ag	Hyde
Zinc Corporation, Broken Hill, N.S.W., Australia	1,000	Zn, Pb, Ag	Minerals Separation
Orijarvi mine, Finland	?	Cu, Zn, Ag	Minerals Separation
1912			
Kyloe Copper mine, N.S.W., Australia	60	Cu	Minerals Separation
Braden Copper mine, Sewell, Chile	...	Cu	Minerals Separation
Etheridge Gold mines, Forsayth, Queensland, Australia	80	Au, Ag, Pb	Minerals Separation
Junction North mine, Broken Hill, N.S.W., Australia	600	Zn, Pb, Ag	Minerals Separation
Chesney Copper mine, Cobar, N.S.W., Australia	400	Cu	Minerals Separation
Kamioka mine, Hida, Japan	?	Zn, Pb, Ag	Potter with oil
Britannia mine, Howe Sound, B.C. Canada	500	Cu	Minerals Separation
Inspiration Copper Co., Miami, Ariz. (first test mill)	50	Cu	Minerals Separation
1913			
Caucasus Copper Co., Dzansul, Russia	?	Cu	Minerals Separation
Falcon mine, Rhodesia	?	Au, Cu	Minerals Separation
Silver Peak mine, Yerranderie, N.S.W., Australia	80	Ag, Pb	Minerals Separation
Cuba Copper Co., Santiago (test mill) Cuba	50	Cu	Minerals Separation
Hewitt mine, Silverton, B. C., Canada	?	Ag, Pb, Zn	Minerals Separation
Standard mine, British Columbia, Canada	?	Ag, Pb	Minerals Separation
Wallaroo Copper mine, South Australia	400	Cu	Minerals Separation
Lloyd Copper mine, Burraga, N.S.W., Australia	?	Cu	Minerals Separation
Mt. Morgan Gold mine, Queensland (test mill) Australia	100	Au, Cu	Minerals Separation
National Copper Co., Mullan, Idaho, U.S.A.	500	Cu	Callow
Atlas Mine, Ouray, Colo, U.S.A.		Au, &c.	Minerals Separation
Zinc :Corporation, Broken Hill, N.S.W., Australia	80	Zn, Pb, Ag	Horwood
Zinc Corporation, Broken Hill, N.S.W., Australia	...	Zn, Pb, Ag	Lyster
Timber Butte Mill, Butte, Mont., U.S.A.	...	Zn, Pb, Ag	Minerals Separation
Seoul Mining Co., Suan, Whang Hai, Chosen	...	Au, &c	Minerals Separation
Miami Copper Co., Miami, Ariz., U.S.A.	50	Cu	Canby
Ozark Smelting & Mining Co., New Mexico, U.S.A.	?	Zn, Pb, Cu	Ozark
1914			
Mt. Morgan Gold Mining Co., Australia	500	Au, Cu	Minerals Separation
Mountain Copper Co., Shasta County, California, U.S.A.	250	Cu	Minerals Separation
Engels Copper Co., Plumas County, California, U.S.A.	200	Cu	Minerals Separation
Old Dominion Mine, Globe, Ariz., U.S.A.	300	Cu	Minerals Separation
Inspiration Cons. C. Co., Miami, Ariz., (second test mill), U.S.A.	600	Cu	Callow, Cole, Minerals Separation, Towne & Flynn, Inspiration
Cuba Copper Co., near Santiago, Cuba	600	Cu	Minerals Separation
Miami Copper Co., Miami, Ariz., U.S.A.	...	Cu	Callow
Consolidated Arizona Smelting Co., Humboldt, U.S.A.	200	Au, Ag, Cu	Minerals Separation
Magma Copper mine, Superior, Ariz., U.S.A.	...	Cu	Callow
Detroit Copper Co., Morenci, Ariz., U.S.A.	50	Cu	Canby
Copper Queen Consolidated, Bisbee, Ariz., U.S.A.	?	Cu	Rork
Arizona Copper Co., Morenci, Ariz., U.S.A.	50	Cu	Towne & Flynn
Burro Mountain Copper Co., Tyrone, N.M., U.S.A.	50	Cu	Minerals Separation
Burro Mountain Copper Co., Tyrone, N.M., U.S.A.	50	Cu	Towne & Flynn
American Zinc, Lead and Smelting Co., Mascot, Tenn	500	Zn	Mechan, Agitation
St. Joseph Lead Co., and Doe Run Lead Co. (3 plants), Missouri, U.S.A.	...	Pb	Mechan. Agitation
Federal Lead Co., Flat River, Mo., U.S.A.	...	Pb	Mechan. Agitation
Desloge Lead Co., Flat River, Mo., U.S.A.		Pb	Mechan. Agitation
St. Louis Lead Co., Flat River, Mo., U.S.A.	...	Pb	Mechan. Agitation
Teziutlan Copper Co., Puebla, Mexico	500	Cu	Towne & Flynn
Moctezuma Copper Co., Nacozari, Sonora, Mexico	30	Cu	Towne & Flynn
Utah Copper Co., Garfield, Utah, U.S.A.	...	Cu	Janney
Sulphide Corporation, Broken Hill, N.S.W., Australia	...	Zn, Pb, Ag	Owen
Broken Hill Proprietary, Broken Hill, N.S.W., Australia	...	Zn, Pb, Ag	Bradford
San Francisco del Oro, Parral, Chihuahua, Mexico	...	Zn, Pb, Ag	Wood (?)

Cananea Consolidated Copper Co., Sonora, Mexico	50	Cu	Towne & Flynn
Federal Mining and Smelting Co., Idaho, U.S.A.	...	Pb, Zn, Ag	Callow
Gold King mine, San Juan, Colo., U.S.A.	...	Au, Ag, Pb	Minerals Separation

Report of the Director of the U. S. Geological Survey

WASHINGTON CORRESPONDENCE

Demand for scientific research never before has been so keen, its purposes so definite or its results so satisfactory. That this is the opinion of George Otis Smith, Director of the United States Geological Survey, is made very plain in his annual report, which was recently presented to Congress.

"Science is regarded as a necessity rather than a luxury," says Dr. Smith. "This coming of science into its own as a large factor in the industrial life of the nation necessarily is followed by a certain reaction of business upon science. The utility of science has become more universally the test of its value."

One of the features of the fiscal year ending June 30, 1916, which is under review in the annual report, is the fact that mineral development is outstripping the facilities of the geologic branch of the Survey. Calls on it for service made by the public have increased greatly and never before were so varied. Despite the fact that there are 188 geologists of various grades in the service of the Survey, work of the most pressing importance, very necessary to the public good, cannot be done, as the geological force is working overtime nearly every day as it is.

Director Smith gives prominence in his report to the efforts being made by the Survey to get before the public at the earliest possible moment the results of work in the field and the significance of statistical and other data which are gathered by the bureau. That accuracy has not suffered by giving such data to the public while it is still news, rather than after it has become history, is pointed out in the report. Announcement Jan. 1, 1915, of the probable output of iron ore in 1914 missed the final figures by only 239 tons. Likewise the statement giving the marketed output of other minerals was estimated very closely, and in practically every case the final figures did not change results by more than 1%. Hundreds of letters have been received by the Survey indicating that the mineral industries have benefited greatly from this policy of releasing information as soon as it reaches the Washington office. There is now no doubt that much of the value of the statistical reports was being lost under the old policy of making the information public only after final figures had been obtained.

In his report Director Smith calls attention to the delay and expense occasioned by 2% of producers who fail to fill out and return the blanks sent them. In running down the production from this 2%, more time is lost than in collecting figures from the other 98%. The cost of gathering this information is also increased greatly by this failure to respond promptly.

In discussing the determined search for potash which is being made by the Survey under the disadvantages of inadequate appropriations, Director Smith points out that from the first it has been recognized that the chances of immediate success are small. This is due to the fact that the area to be explored is large, the funds available are small and to the fact that the surface indications that may help in determining the most promising places for drilling are only of the most general nature. In view of the great demand for an adequate supply of cheap potash in this country—and if potash is to be obtained at a low cost it must come from deposits in the earth—Director Smith believes that systematic drilling in the "Red Beds" of the Southwest and in other places where there is geological evidence that potash may have been precipitated must be continued.

What is characterized by Dr. Smith as "a notable contribution to geologic literature in its broadest relations" is the report of Grove Karl Gilbert on "Hydraulic-Mining Débris in the Sierra Nevada," which will be published by the Survey during the coming year.

Director Smith's report is a condensed analysis of the work done by the Survey during the year. Even the brief treatment given the principal activities of the bureau furnishes material for 173 printed pages.

New Graphite Discovery

The curtailment of the supply of raw materials has been a serious problem to the American manufacturer, but from the standpoint of our future commercial welfare this shortage has proved a blessing in disguise. The high prices have led to the development of chemical and other processes to meet the shortage, while intensive prospecting has brought to light many commercial deposits of minerals.

The bulk of the supply of graphite used in this country has been obtained from the Island of Ceylon, off the southern coast of India, but this supply has been seriously curtailed by the lack of shipping facilities. The New York State Department of Labor points out that search for this mineral has recently brought to light the largest known deposit of high-grade ore on this continent. It is between Lake George and Lake Champlain in the vicinity of Black Mountain. The famous mine opened by the Joseph Dixon Crucible Co., in 1878, is in this section and in the same geological horizon. This mine is still being operated, but the new find is said to be several times as large as the Dixon deposit. The vein outcrops for nearly a mile with a thickness of 50 ft. The graphite content indicates a variation of 6 to 10% of the large flake variety desired by the manufacturers of crucibles, while a 6-ft. layer in the deposit assays over 15% of the same high-grade graphite.

For the purpose of milling the ore a 100-ton mill unit has been erected, which will be added to next year when mine operations will have been developed sufficiently to furnish an increased supply of ore.

The property is owned by Hooper Brothers, with headquarters at Whitehall, N. Y. Their father, William Hooper, was the pioneer of the graphite industry in this county, having erected the first concentrating plant for the treatment of graphite ore in Ticonderoga during war times.

The owners, George H. and Frank C. Hooper, who have specialized in graphite mining and graphite separation, have in this an ideal deposit as regards size, richness and situation. Their power plant, when erected, will be below the mine on the bank of South Bay, connected with Lake Champlain and the Barge Canal.

Some Observations on Sampling

By Irving Herr*

SYNOPSIS—Mill runs often do not come up to the results expected from sampling. Various examples of a spotted deposit show that the error may be as great as 49% even though due care was exercised while sampling. At best sampling is only a means of approximation.

For a number of years, while superintendent of one of the silver-gold mines of the Guanajuato district in Mexico, I was confronted with the fact that the results of our mine sampling were not always dependable. It was usually found that when mining of any particular portion of the developed orebody began, the grade of the broken ore was lower than that expected and shown to exist according to the sampling record.

As the development of the mine progressed by the usual drifts, raises, winzes, etc., these headings were sampled by the mine engineer. The method usually followed was that of taking cuts across the roof of the drifts at regular intervals, usually one meter apart. This frequently alternated with sampling of the face of the headings, in which case two and sometimes three cuts taken across the face or across the width of ore exposed in the face constituted a sample.

When the ore thus blocked out came to be mined, the value of the broken ore was considerably less than that calculated from the sampling records. This was particularly noticeable in the case of one large stope which for a number of months formed the main ore supply for the mill. When ore breaking began in this stope, the grade of the broken ore was so much lower than that expected from the previous sampling of the block that all the calculations of the management on probable mill returns were upset and a situation of some delicacy arose between the mine engineer who did the sampling, the mine foreman in charge of breaking the ore and the management.

Mill Runs Always Lower Than Sampling Results

For a while it was believed that either high-grading was being carried on in a very extensive manner or else the mine foreman was allowing a much greater width of ground to be broken than was warranted by the sampling and thus permitting the ore to be diluted with waste from the foot and hanging wall. Special attention was directed toward the elimination of these defects, and as often as possible the bottom of the stope was carefully sampled over its entire area by the engineer. This stope continued to be a disappointment throughout its life, and the grade of the broken ore continued lower than that shown by the stope sampling. The ore was in the main low-grade, but with numerous bunches and stringers of high-grade scattered through it. I have discussed this matter with the superintendents of other Guanajuato mines and have found their experience to be similar. One said that he always deducted about 20% from his mine samples in order to check the mill heads.

I believe this has probably been the experience of a number of mine managers, especially those who are mining orebodies in which the mineralization is uneven; where high-grade masses, stringers, or bunches are disseminated through a main body of low-grade ore, which is frequently the case in Guanajuato.

Such differences between values anticipated from sampling and values actually contained in the broken ore may be attributed to careless sampling or poor judgment on the part of the engineer in charge of the sampling, or to the subsequent breaking of greater widths in stoping than were sampled and the consequent dilution of the ore by inclusions of waste rock from foot or hanging wall. The main question is not how these differences occur, but how they may be avoided, and in studying the subject I have been impressed with the fact that it is often difficult to correctly sample such ore and that perhaps the engineer is sometimes blamed for carelessness when he was using every precaution and exercising care to the best of his ability. If errors occur, they will be rather on account of bad judgment where correct judgment is difficult to attain. Such errors are apt to balance themselves in the long run, and if the sampling extends over a sufficient area, the average of all the samples should be very nearly correct. But I believe that in a limited area the error may be unbalanced.

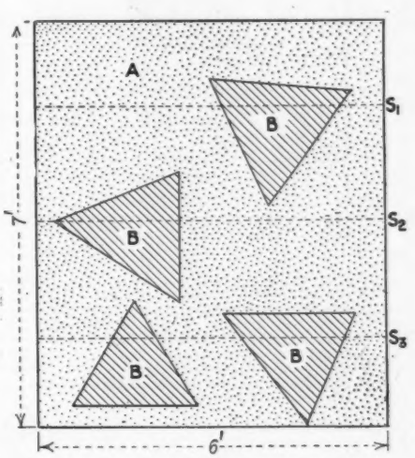


FIG. 1

Area of face ..... 42 sq.ft.
Area high grade ($100)..... 9.37 sq ft.
Area low grade ($10)..... 32.63 sq ft.
Average valeu of face = $30.08.
Total length sample cut ..... 18 ft.
Total length high-grade cut ..... 7 ft.
Total length low-grade cut ..... 11 ft.
Average value by sample, $45.
Error + $14.92 = 49.6%.

Fig. 1 is a theoretical case showing the face of a drift on a vertical vein whose width is that of the drift. The drift is 6 ft. wide and 7 ft. high. The vein filling consists of uniform low-grade ore *A* in which are four irregular-shaped bunches of high-grade ore *B*. The low-grade assays $10 per ton, while the high-grade assays $100 per ton. Three sample cuts are made along the lines S_1, S_2, S_3. The area of the high-grade ore exposed in this face is such that the average value over the entire face is $30.08 (see calculation under Fig. 1), while the average value according to the sample is $45, an error in sampling of $14.92, or 49.6%.

The Question of Representative Sampling

A little study of this figure shows why the sample is so unrepresentative, but it is my opinion that many engineers in the course of the day's work might sample a face similar to this and believe they had taken a fair sample. Moreover, to calculate in this instance where the sample cuts should have been taken in order to obtain a correct sample would be difficult. This case seems to indicate that the only true sample of a face of this character is one where

*Mining engineer, Cambridge, Mass.

the entire area of the face is cut down—obviously quite impracticable. The next most dependable sample would be one of the muck broken down by a round of holes covering the entire face. A careful sample of the muck should be more reliable than any ordinary cut sample. I think, as a general rule, where both muck samples and cut samples are taken, more reliance is likely to be placed, unjustly, on the cut sample.

Fig. 2 is another example illustrating the same idea. Here the shaded portion is high-grade ore running $100 per ton, while the light area *A* is ore of $10 grade. In this case the actual average value of the face is $47.10 while the sample gives $51.25, an error of $4.15, or 8.8%. From a casual inspection of Fig. 2 the sampling looks quite fair and representative. The ultimate degree of accuracy obtained in sampling along a drift in this manner depends upon the law of averages; some samples will be too high, others too low. There is a probability that the sampler will oversample rather than undersample. The psychological process by which this comes about is somewhat as follows:

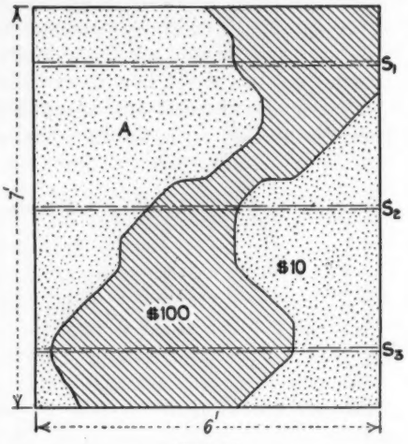


FIG. 2

Total area of face..... 42 sq.ft.
Area of high-grade ore ..... 17.3 sq.ft.
Area of low-grade ore ..... 24.7 sq.ft.
Average grade of ore in face, $47.10.
Total length of sample cut..... 18 ft.
Length of high-grade cut ..... 8.25 ft.
Length of low-grade cut ..... 9.75 ft.
Average grade by sample, $51.25.
Error + $4.15 = 8.8%.

The sampler knows that he is liable to err on the high side and must take precautions against it. In most cases the barren or low-grade ore is harder and more difficult to cut than the richer portion. In his zeal not to slight the low-grade, considerable time and muscle are expended in cutting this part of the sample. In fact, by the time he has broken off what is really a fair proportion of it, he has expended so much time and force that he unconsciously believes he must have taken too much. In an effort to be fair he will probably add a little more of the better ore and salt the sample.

All hands, including the engineer, about a mine are glad when there is good ore on hand. If the development faces are running well, the whole atmosphere around the property is more cheerful. The tension slackens a bit, and good fellowship increases. The mine foreman coming off shift drops into the office and in an unobtrusive manner glances over the assay sheet for the day. If the faces of his headings are sampling well up, he closes the book with a grin.

Is it much to be wondered at, then, that the mine sampler, while aiming to be careful and conservative in his work, also wants to do the fair thing by the ore and unconsciously believes that his very precautions against too high results may cause his samples to run lower than they should and is influenced thereby? Apart from all this is the case where the sampler actually is careless, and then in the majority of cases his samples will be too high because it is easier to break the good ore and because pieces of soft friable high-grade will slough off the face into the sample while the harder ore is being cut.

Examples of Errors in Sampling

Fig. 3 represents an underhand stope *a-d*. This is supposed to consist of uniform low-grade ore *A* with occasional masses of higher-grade ore *B* scattered through it. Let this stope as it is mined down be sampled along the lines S_1, S_2, S_3 and S_4. Let $100 per ton be the grade of the masses of high-grade, and $10 per ton be the uniform grade of the balance of the ore. If the stope is 2 units wide, 6 units long and 6.5 units in depth, while the volume of each of the high-grade bodies is 1, then the average value of the ore in the stope is $14.62. But the sampling along the lines S_1-S_4 gives a total area of sample of 48 square units, of which 4 are high-grade ore. The average, then, according to the sampling is $17.50; an error of $2.88, or 19.7%. Had the small masses of high-grade ore been increased by the small volumes *C*, as shown in Fig. 4, and the sampling lines remained the same, the sampling results would have been correct, for in the latter case the volume of high-grade ore is increased to 6.5 cubic units without increasing the area of high-grade in the samples, and the following necessary ratio is found to exist:

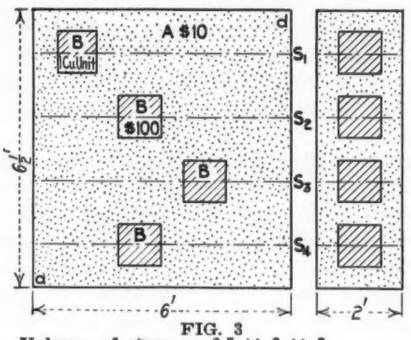


FIG. 3

Volume of stope = 6.5 × 6 × 2
= 78 cu.units
Volume of high-grade = 4 cu.units
Volume of low-grade = 74 cu.units
Average value of ore in stope, $14.62.
Area of samples 6 × 2 × 4
= 48 sq.units
Area of high-grade sampled 4 sq.units
Area of low-grade sampled. 44 sq.units
Average value by samples, $17.50.
Error + $2.88 = 19.7%.

$$\frac{\text{Area of high-grade sampled}}{\text{total area of samples}} = \frac{\text{volume of high-grade}}{\text{total volume of orebody}}$$

The conclusion that I draw from this is that in dealing with orebodies that are not homogeneous in character and where the ore contains irregular masses of distinctly higher grade ore, it is difficult to get reliable samples by taking cuts over the surface of the body. The reason that the ore represents a volume, while the sampling represents a surface only; one a figure of three dimensions, the other of only two. In order to sample correctly such a body, the proportion previously indicated must hold true, and this is obviously difficult of attainment. The more frequently cuts are taken, the better they represent the actual value of the ore.

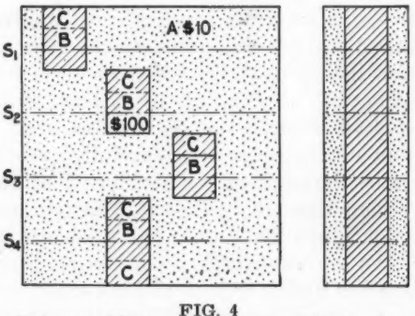


FIG. 4

Volume of stope = 78 cu.units
Volume of high-grade B + C, 6.5 cu.units
Volume of low-grade..... 71.5 cu.units
Average value of ore in stope, $17.50.

Another example of a stope in which the broken ore would consistently show lower values than the sampling is one in which, beginning at the top with a certain grade of ore, the grade continually decreases as the stope is worked down. In this case, if the sampling of the floor where the stope is begun shows a certain value, the first lot of ore broken will give lower returns than the sampling because it is a mixture of the higher-grade ore from the plane of the samples and lower-grade from the bottom of the cut removed from the stope.

South African Mineral Production in 1915

The annual report of the Department of Mines and Industries for 1915 contains the following information relative to the production of the several minerals given for 1914 and 1915:

Product	1914	1915
Gold, oz	8,396,068	9,096,410
Silver, oz	890,781	966,176
Diamonds, carats	2,801,016	103,385
Coal, tons	8,477,923	8,281,324
Coke, tons	6,493	7,279
Tar, gal	2,225	26,050
Copper, tons	29,325	28,969
Tin, tons	3,429	3,441
Asbestos, tons	1,190	2,138
Graphite, tons	34	41
Magnesite, tons	572	627
Antimony, tons	.....	89
Lead, tons	136	180
Zinc, tons	.....	352
Corundum, tons	12	68
Nickel, tons	.....	2
Mica, tons	.....	2
Iron pyrites, tons	.....	545
Kaolin, tons	.....	20
Talc, tons	.....	44
Salt (including byproducts), tons	40,290	45,104
Soda, tons	2,593	6,303
Lime, tons	66,095	68,989
Flint, tons	425	453
Gypsum, tons	1,791	2,838

The total value of these products in 1914 was £45,366,-224, while the 1915 production was valued at £43,531,009. The greatest single increase was in gold, in which £2,974,-865 was recorded. The chief decrease was in diamonds, where £5,087,384 was recorded.

A report on the asbestos industry is included, as the interest in asbestos has increased as shown by the substantial increase in output.

A total of 299,673 men were employed in the mining and metallurgical industry during 1915. Of these 29,604 were white, 4,311 Asiatic and 265,758 natives.

In gold mining the tendency has been to employ a higher stamp duty and work a slightly lower-grade ore. On the Witwatersrand a duty of 9.335 tons per stamp was employed, while in the Transvaal 9.156 was used. Waste to the extent of 9.36% was sorted out. The average value of ore worked was 26.319s. ($6.40) per ton and working costs were 17s. 6d. ($4.26), leaving a profit per ton of 8s. 9d. ($2.14).

Operating Electric Steel Furnaces

A writer in a recent issue of *L'Echo des Mines et de la Métallurgie* suggests the installation of electric furnaces in towns, in order to utilize the electric units lying idle at the power station during slack time, says *Iron and Coal Trades Review*, Nov. 10, 1916. He saw the first installation of this kind about eight years ago in a suburb of Turin. There were two small Stassano furnaces of 100 hp. each, and two of 1,000 hp. each, both taking their current direct from the town supply.

In France the idea is making headway. Just outside Limoges a Keller furnace has been installed capable of smelting down 30 tons of iron turnings and other cheap scrap per day, and producing 25 tons of high-priced cast metal, in conjunction with dephosphoration or without it, or turning out ordinary cast iron of high quality when the current is obtainable at a low rate. The furnace occupies a very small space in the tramway depot and requires little attendance owing to the provision of ample labor-saving appliances. The current in this case is transmitted from a hydraulic power station to Limoges at 30,000 volts, where it is transformed down to 10,000 and then again to 110 volts to suit the voltage of the furnace. The consumption of current is about 700 to 800 kw.-hr. per metric ton of metal produced. The first heat would, it is presumed, have to start about midnight, or soon after the peak load is passed at the power station.

New South Wales Copper Output*

The copper production of New South Wales for 1915 was valued at £234,437, a decrease of £40,234 from that of 1914 and the smallest return recorded since 1896.

Of this production, the mines of the Cobar district supplied the largest part, with a value of £134,212; compared with £116,460 for the previous year. The Cadia Copper plant produced 500 tons of copper matte valued at £16,011, or a decrease of £24,848 from the 1914 record. The Grafton mine at Cangai shows a slight increase over 1914, the yield being 161.32 tons of matte valued at £6,488. The Mouramba Copper Mines, Ltd., at Nymagee smelted 18,500 tons of ore and obtained 663 tons of copper valued at £37,780. At the works of the Electrolytic Refining and Smelting Co. of Australia, Ltd., the production included 20,733 tons of copper, the greater portion of which was obtained from imported blister copper.

Lead-Coated Steel Sheets

The Ledcote Co. of Canada, Ltd., Amherst, N. S., is making steel sheets coated with lead electrolytically deposited, which is offered for constructional ironwork. These lead-covered sheets are a substitute for galvanized sheets.

The Ledcote Co. informs us that it uses the ordinary electrolytic process of lead depositing. It has, however, developed a solution that enables it to deposit lead on iron, wood or plaster to any thickness without flaking or peeling. This has not previously been possible, the thickness capable of being deposited without peeling being so small as to make it of little value commercially. The new process has overcome this difficulty. The company controls this process for the United States and Canada.

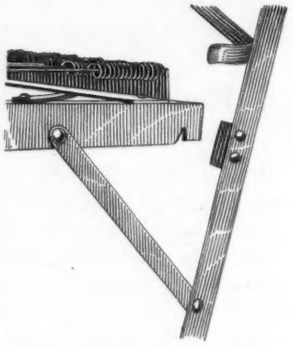
Aluminum Exports from Switzerland to Germany in 1915, according to Swiss reports, were 12,000 to 14,000 tons, according to "Iron Age," Nov. 9, 1916. Before the war Germany obtained aluminum from Switzerland, France and Canada. The Aluminum Industrie A. G. is now the largest source of the German aluminum supply, with the largest plant at Chippis, in Valais, at the junction of the Rhone and the Navizance.

*Excerpt from Annual Report of the Department of Mines, New South Wales, for the year 1915.

Details of Practical Mining

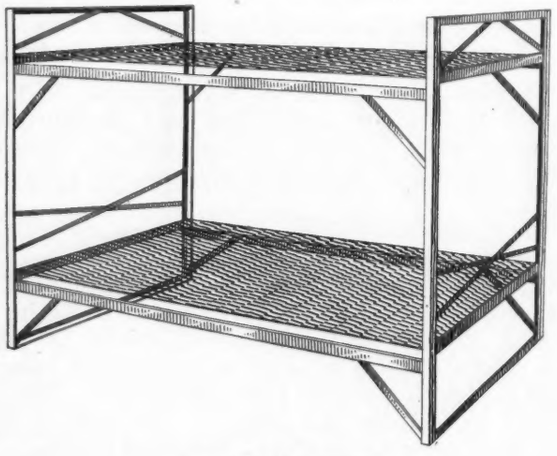
Sanitary Steel Bunks

A new feature in the construction of steel bunks is the device here shown (from *Excavating Engineer* for October, 1916), which illustrates a boltless locking device, on the Tiger steel bunk. The corner of the bunk, shown in detail, is a view taken from the side. The angle side rail is notched near the end of the rail. This engages with a flange riveted to the angle which forms the upright of the frame. A swinging lug, which is shown immediately above these two parts, is brought down to rest on the upper surface of the side angle, thus making firm joint between the slotted part of the angle and the flange on the upright piece. It is a perfectly rigid piece and requires no tools to complete the operation, which consists in simply slipping the angle side rail over the flange, and hammering the lug into place. This device is offered for the convenience of those who require a sanitary portable bunk. The Tiger steel bunk, when completely set up, presents the appearance here illustrated.



KNOCKDOWN FEATURE OF BUNK

The steel bunk has made a place for itself in modern camp equipment. It is much more sanitary and durable than the old-style wooden bunk or wooden cot. The wire-link fabric, with the helical springs, makes a comfortable bed, and in these times, when the question of securing satisfactory labor is so important, a good bed under sanitary conditions has much to do with assuring a satisfactory final result.



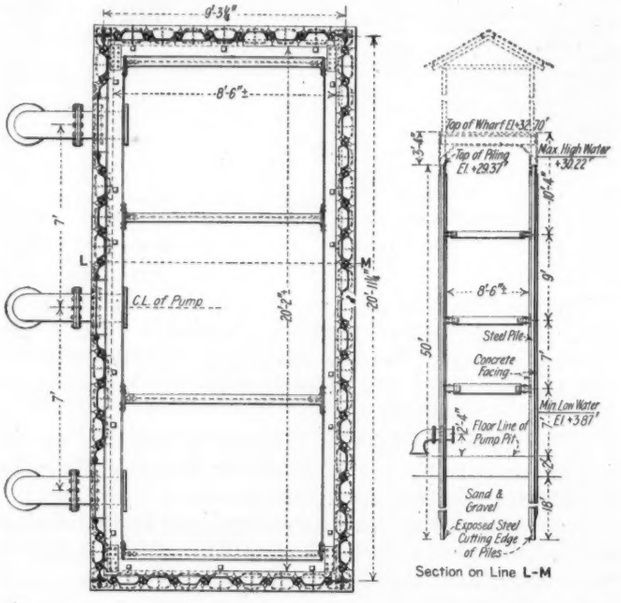
A SANITARY BUNK

Tiger steel bunks are made by Haggard & Marcusson Co., 1113 West 37th St., Chicago, Ill.

Pumphouse Construction Under Severe Tidal Conditions

By Charles S. Boardman*

The Alaska Treadwell Gold Mining Co., at Treadwell, Alaska, found early in the year 1914 that it was necessary to construct a new intake and pumping plant. This new central pumping plant, situated at its dock face in the tidewaters of the Gastineau Channel, was to be built on sand and gravel foundation over which there was but a few feet of water at extreme low tide. The pump station, 8 ft. by 19 ft. 6 in. inside dimensions, was to be constructed 30 ft. in height above a concrete base or floor to protect pumps, shaft, etc., from the action of the tide, which has a range at this point of about 26 ft. It was to contain three horizontal centrifugal pumps, having a capacity of 2,800 gal. per min., working under a head of 125 ft. These pumps were to be electrically driven and set on the floor of the pumphouse 5 ft. above high tide. They were required to furnish circulating water for condensing purposes, and suction pipes were to extend outside of the pumphouse below mean low tide.



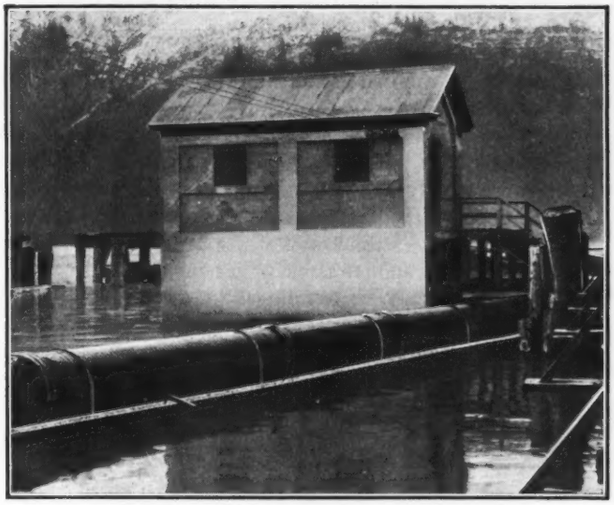
PLAN AND ELEVATION OF PUMPHOUSE FOUNDATIONS

After considerable study on the possible methods of construction for a pumphouse in such an exposed situation and subjected to such a high range of tide, it was decided to attempt the use of steel sheet piling. Accordingly an order was placed with the Lackawanna Steel Co., of Buffalo, N. Y., on plans drawn for its protected steel sheet piling.

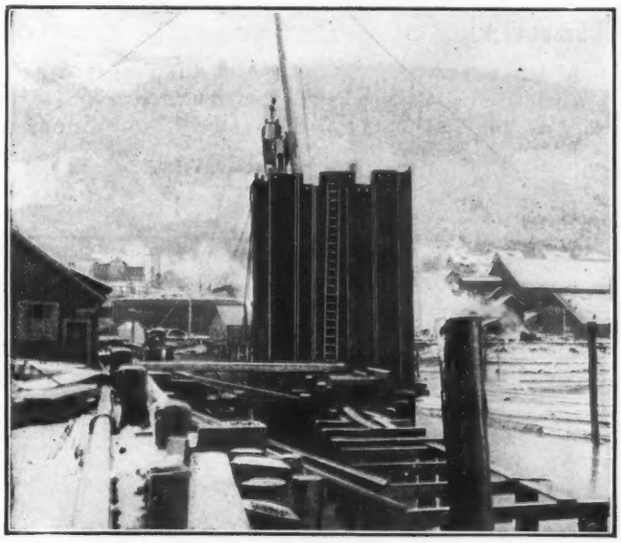
To accomplish this, 65 tons 14x⅜-in. arch-web steel sheet piling was ordered.

*Engineer, Lackawanna Steel Co., Buffalo, N. Y.

This piling was all fabricated before shipment, the necessary reinforcing rods, special piling, etc., being shipped from Buffalo. In carrying out the construction at Treadwell, the only departure from the original plans was that the concrete was placed on the sheet piling after it was driven into place, instead of premolding it as it was first contemplated. The method of procedure in this construction was to set up vertically around a driving form the entire 46 piles, comprising the caisson, as shown in



VIEW OF COMPLETED PUMPHOUSE



DRIVING THE SHEET-PILE FOUNDATION

the accompanying illustrations. When thus set up the piling was driven a short distance, driving on one or two bars at a time, continuing this driving around the perimeter of the caisson until all the piles were driven to their final position.

From the plans it will be seen that while this is a small pumphouse, the details of the piling and structural steel are rather complex. The piling used was of sufficient section to establish the strength of this pumphouse wall vertically between the three sets of structural-steel braces and concrete floors, and to enable them to resist the extreme water pressures at high tide.

The 18 ft. of penetration of sheet piling below the reinforced-concrete floor enabled the pumphouse to retain its vertical position, and prevented any sliding of the structure. Details for the junction of the piling walls and the three suction pipes through them, were successfully carried out by fabricating three wide sheet piles each with a plate ½ in. by 2 ft. 6½ in., 50 ft. in length, as a web, reinforcing this web with six angles and bolting the 12-in. cast-iron nipples to the web of the piling at these three openings. This structure has proved, upon completion, to be substantial, strong and entirely watertight, meeting in every way the conditions required. The designs for the pumps, motors, etc., were prepared by C. C. Moore & Co., San Francisco. The design for the pumphouse structure was passed upon by them, and the construction itself was carried out under the general direction of P. R. Bradley.

Salt Water Causes Crack in Concrete in Philippines

The cracking of reinforced-concrete structures is markedly prevalent in the Philippine Islands, according to a report by J. L. Harrison, District Engineer, Iloilo (in the "Bulletin" of the Bureau of Public Works, October, 1916), abstracted by *Engineering News,* Nov. 30, 1916. The accumulation of evidence of this trouble became so serious about two years ago that it was decided by the authorities to make some studies into the cause. They proceeded first on the assumption that the rusting was wholly chemical—stimulated by appreciable quantities of some determinable material; and a number of samples of concrete taken from structures in trouble were subjected to chemical analysis.

The samples submitted showed one foreign substance—chlorine—and that indicated the presence of salt. At first not much attention was paid to this, as it was known that it was largely used in the United States to prevent freezing of concrete during setting; but it was soon realized that the climatic conditions in the Philippine Islands are so different from those in the United States that the effect of the salt could not be neglected. The collection of analyzed samples has gone on for something over two years and not a single structure showing rusted steel has been found free from salt. The percentage of this salt has varied considerably—from that high enough to show that beach sand and sea water must have been used in making the concrete, to a figure low enough to indicate that either brackish water was used or that salt water was used to wet down fresh-water concrete after the forms had been taken off. A typical sample (from the Constabulary Headquarters building, Iloilo) showed 0.07% chlorine. This was computed to be equivalent to 1.44% salt in the water, assuming 12.5 lb. of water used per cubic foot of concrete. This is considered fairly salt water.

The presence of 0.10% chlorine in the iron rust indicated too small a percentage of ferric chloride to explain all the indications of rusting to be observed; but it was realized that ferric chloride is not stable and that it readily oxidizes to ferric oxide, releasing the chlorine for further attack. High temperature and moisture are the only conditions necessary for the indefinite continuation of the process, and both of these conditions prevail throughout the Philippine Islands.

Not every structure in which salt water has been used, or in which salt is found, goes to pieces in this way. There

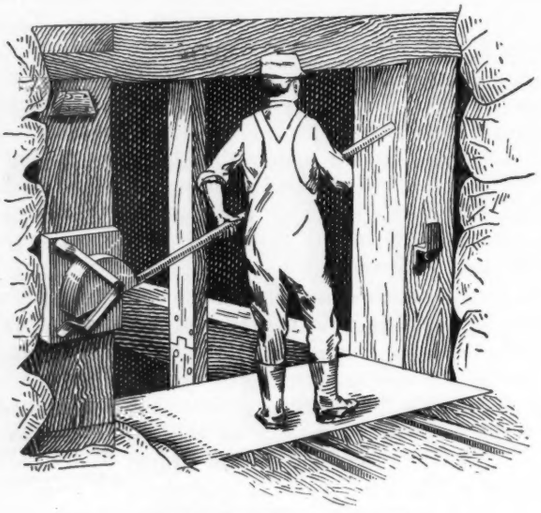
are several such buildings in good condition. However, the concrete in them is unusually dense, and it is thought that their success in withstanding the influence of the salt is due to the density of the concrete.

Engineers in the Philippines have been accordingly advised that all use of salt water in concrete structures is dangerous and that the use of beach sand and beach gravel should be permitted only after thorough washing with fresh water.

Simple Shaft Gate at Junction Mine, Warren, Ariz.

At the Junction shaft of the Calumet & Arizona Mining Co., Warren, Ariz., a shaft gate is used that is simple and cheap and has an inherent tendency to stay shut when it should be shut and to stay open when it should be open.

The gate consists of a piece of 1½- or 2-in. pipe on one end of which is a semi-circular section of cast iron pivoted as shown. When the gate is closed, the weight



A SIMPLE SHAFT GATE

of the pipe has a greater moment-arm than the counterweight and it naturally stays closed. When the gate is lifted about two-thirds of the way up, the center of gravity changes so that the counterweight tends to keep on rotating and after the pipe passes the vertical the moment of both pipe and counterweight act together to hold the pipe against the stop *A*. A plate *B* is used on the center post to give a bearing, and the iron straps *C* support the bearing pin and provide a guide for the counterweight so that the far end of the gate never misses the clip *D* and falls down. It is a clever gate.

How To Waterproof Drawings

A few methods for waterproofing drawings were noted by F. W. Salmon, in *Engineering News,* Nov. 30, 1916, all of which are useful and satisfactory.

A. Give the drawing several light coats of white shellac dissolved in a grain alcohol, letting each coat dry before the next is applied. Orange shellac and even wood alcohol may be used; but I much prefer the "white" or bleached shellac, and I object to the wood alcohol because of its injurious effect on the eyes.

B. Give the drawings several light coats of "Zapan" varnish, which, I understand, is made of scrap trimmings of clear sheet celluloid dissolved in acetone and is produced by several Eastern chemical factories and firms manufacturing celluloid articles.

C. When a heavier protective covering is desired than A or B will provide, the drawing may be made wet with the thin celluloid varnish and pressed down evenly on a sheet of thin sheet celluloid, then allowed to dry. This process gives a beautiful clear mounting with 0.01 in. of celluloid on the face.

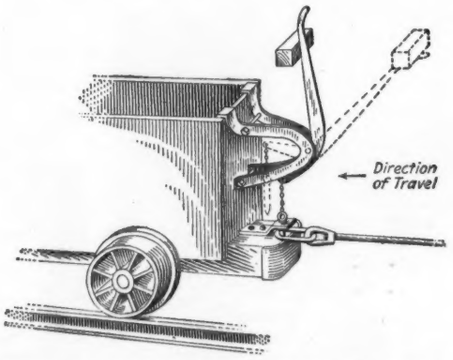
D. Drawings may be made waterproof with paraffin wax, which is applied hot (melted) with a flat bristle brush. The drawing is then put between two sheets of blotting paper, and a hot (electric) sad-iron is passed over the upper blotter, thus causing the paraffin to be distributed more evenly and the surplus to be absorbed by the blotting paper. The blotters must be removed before they cool. If the wax is thick and white over any part of the drawing or print, sponge it off with benzine.

E. Drawings may be paraffined by dissolving the paraffin wax in benzine and then thoroughly painting the drawing with this liquid or passing the drawing through a bath and hanging it up to dry.

Some of the solvents mentioned are very inflammable and even explosive, so all open lights should be kept away from them. Sometimes they affect certain people injuriously; accordingly, such work should be done only in a well-ventilated room, with a fan to keep fresh air moving.

Handy Rope-Detaching Device

At one mine a man was dispensed with and a dangerous job eliminated by having a tool made to uncouple the rope at the foot of an incline, says R. Z. Virgin, in



DEVICE AUTOMATICALLY RELEASES ROPE AT FOOT OF PLANE

Coal Age, Nov. 11, 1916. The device is fastened to the rear end of the trip. It pulls the pin, detaches the rope, and the trip runs onto the siding.

The overhead knocker is placed at the point where the rope is to be attached to the loaded trips to make the return journey up the incline.

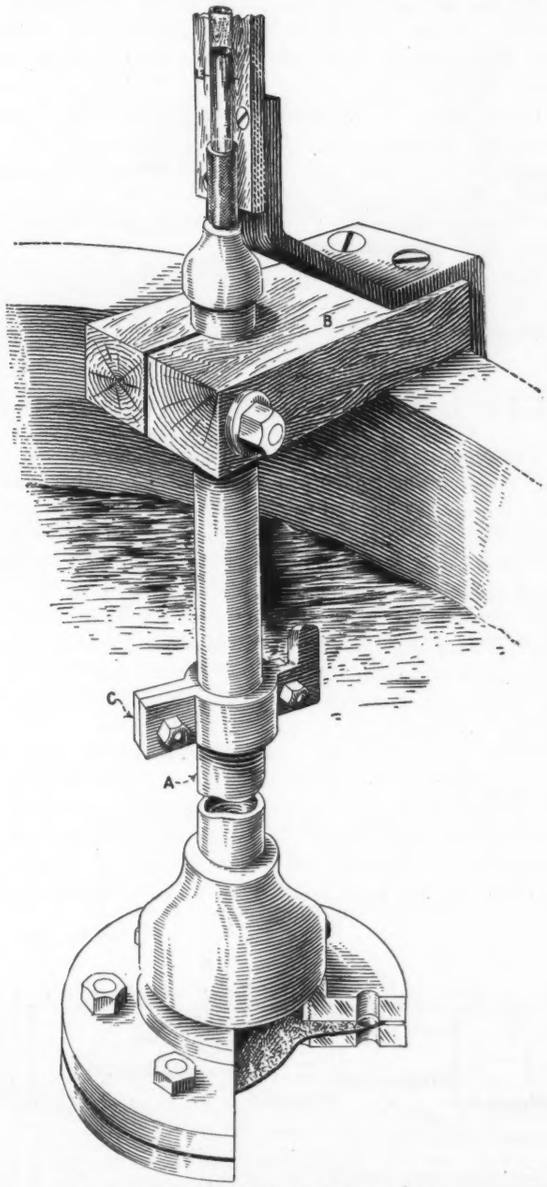
American Lithographic Stone—The only American company producing lithographic limestone in commercial quantities is the Kentucky Lithograph Stone Co. of Brandenburg, Ky. This company's quarries are producing a stone rivaling in quality the Baravian product which was used in America almost exclusively up to the outbreak of the European war. One of the recently developed industries requiring quantities of stone is the manufacture of colored posters for moving picture plays, a business which has attained large proportions.

Details of Milling and Smelting

A Simple Pulp Indicator

By C. W. Dowsett*

An appliance designed to show at all times the specific gravity of pulp under agitation in a Pachuca tank has been tried out with successful results. It is shown



PULP-DILUTION INDICATOR

in the accompanying illustration. *A* is a 1-in. iron pipe of such length that its lower end can be submerged 10 ft. in the pulp while the upper end is about 6 in. above the surface. The pipe is suspended from the wooden clamp *B*, which rests on the top of the tank. At the lower end of the pipe a 2-in. to 1-in. reducer is attached, and to this, by means of a nipple, a flange is screwed, across the opening of which a piece of cotton filter cloth is stretched. Another flange is then bolted on to hold the cloth. A clamp *C* is fixed in such a position that its horn, as shown in the sketch, is exactly 10 ft. above the surface of the filter.

The air lift of the tank is shut off for a few seconds, and when the surface movement has subsided, the pipe is adjusted in the clamp *B* until the top of the horn on *C* is just on a level with the pulp surface. The pipe at the top is now reduced to ¼ in. by means of a plug and nipple. With a short piece of rubber tubing the nipple is connected to a length of glass tubing supported vertically on a board, the lower end of which rests on *B*.

The zero point is on the pipe level with the horn on *C*. At a point, say, 2 ft. above *C* there is marked on the board a line designated at 1.2; a point 1 ft. above that will be 1.3, and so on. The distances between these points is marked off in intervals of $\frac{1}{10}$ ft. If required, these latter may be further subdivided.

Now, assuming that the pulp in the Pachuca tank has a specific gravity of 1.45, the clear solution in the glass tube will be forced up to a point 4.5 ft. above the zero mark; or in other words, a 10-ft. column of pulp at 1.45 specific gravity will exactly support a 14.5-ft. column of water or solution at a gravity of 1.

It is essential that all joints in the apparatus be perfectly tight, for should slimes leak in at any part of the pipe near the bottom, the specific gravity of the column in the pipe would rise above 1 and a reading lower than the true figure would be recorded. Should there be a leak at the top of the pipe at the junction, say, of the iron pipe with the glass tube, a low reading would be recorded, for the filter might not be able to pass solution quickly enough to maintain equilibrium.

*Mill superintendent, Dome Mines, Ltd., South Porcupine, Ont.

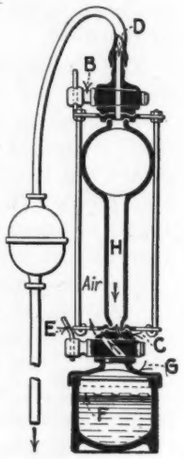
New Electric Process for Brass and Copper Alloys

G. H. Clamer, of the Ajax Metal Co., Philadelphia, has patented a process (U. S. Pat. 1,198,618, Sept. 19, 1916) for making brass and copper alloys. As noted in *Iron Age,* Nov. 30, 1916, melted copper of the correct "pitch" is drawn off into an electric furnace. Zinc and other alloying metals are then added. Economy is claimed for this procedure because large quantities of copper are melted and brought to the proper "pitch" before entering the electric furnace; because alloying is done therein, and because the casting is accomplished at the proper temperature. The ease of regulation of the atmosphere to neutral or reducing and the simplicity with which the temperature can be controlled are claimed as important factors. Little or no zinc is reported as lost by volatilization. Large slabs may be cast, which is pointed to as a saving.

Mining & Metallurgical Machinery

A Mechanical Analyzer for Carbon Dioxide

The need of a compact, accurate and quick analyzer for carbon dioxide has been met by the Bacharach Industrial Instrument Co., Pittsburgh, Penn., which has perfected the appliance here described. By its use 17 to 20 determinations may be made per hour by an inexperienced man within an accuracy of 2%. A solution of KOH in water is used as a reagent, and several hundred determinations can be made with one change. The instrument consists of a measuring tube *H* (in the illustration), a glass jar *F* containing the KOH solution and the metal connecting body *C*. Valves at *B* and *E* regulate the flow of the liquids. A sample of the air to be tested is taken, and the percentage of CO_2 is read directly from the calibrations on *F*, after the valves have been closed and the CO_2 subjected to the action of the KOH solution. This is accomplished by the entrance of water to replace the absorbed CO_2. The apparatus is most serviceable both as to design and construction.



APPARATUS FOR CO_2 DETERMINATION

Denver Dreadnaught Drill

The Dreadnaught drill is the machine credited with breaking all tunnel-driving records when by its use the Rogers Pass Tunnel, at Glacier, B. C., was driven 678 ft. per month, or nearly 22 ft. per day. It is claimed for the drill that it combines a maximum of drilling power with a minimum of weight, and it is adaptable to any type of excavation from drifting and stoping to raising and sinking.

Mounted, its weight is 140 lb., but when equipped with a spring handle and used as a hand drill, the weight is 83 lb. It is fitted with chucks to use either 1⅛-in. or 1¼-in. steel. Hollow steel is used, delivering either water or compressed air to eject the rock cuttings. The drill is valveless and uses compressed air expansively. Rotation, as seen in the illustration, is accomplished entirely in the front head and is positive and powerful. All of the chuck end may be removed without taking down the drill.

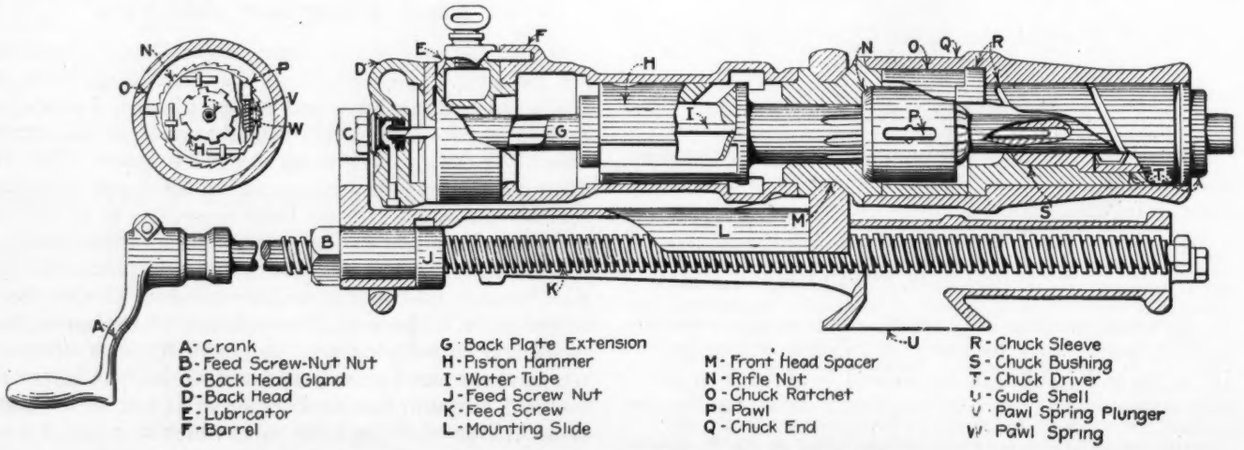
Lubrication is automatic, the lubricating chamber requiring refilling only two or three times per shift. By means of the mounting, the drill proper may be quickly removed from the feed shell and slide by the removal of the two nuts that clamp the drill in the yoke immediately behind the front head.

The manufacturers, the Denver Rock Drill Manufacturing Co., of Denver. Colo., have just issued Bulletin D-60 describing this drill in detail.

Clark Compressed-Air Meter

The amount of compressed air consumed by rock drills and coal-cutting machines is usually a rather vaguely known quantity around mines. Every miner believes each type of drill requires just about so many cubic feet of free air per minute, but this belief is likely to be based largely upon claims set forth by the manufacturers of the drills and cutters. It is in the power house that doubts are entertained regarding these figures of air consumption, but here the superintendent is so far away from the consuming units that any excess over the calculated demands is usually accounted for as leakage in the lines.

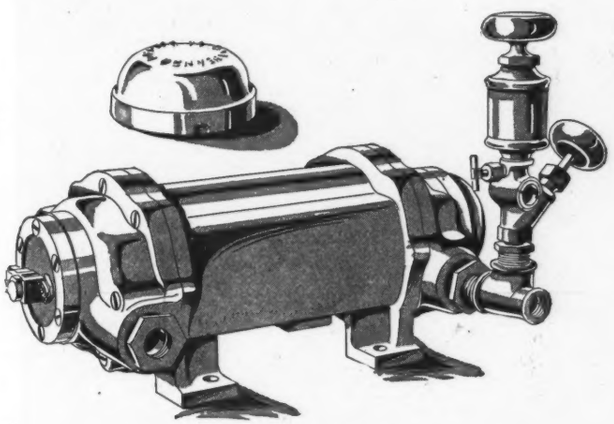
For a long time unsuccessful attempts have been made to construct a serviceable, portable device whereby the air actually passing through a pneumatic machine could be measured, but recently the Denver Rock Drill Manufacturing Co. placed upon the market a meter that answers all the requirements of such a machine while



SECTIONAL VIEW DREADNAUGHT DRILL, SHOWING PARTS

avoiding the defects in previous types. The accompanying illustration shows a complete meter whose compactness is evident. It is made in one size only—capable of accurately measuring any quantity of free air up to 200 cu.ft. per min., this being a quantity sufficient to operate almost any type of machine around a mine. If it is required to measure a greater quantity of air, two or more of these meters may be placed in parallel.

This meter is intended to be placed close to the machine whose air consumption is being tested, and to which it is attached in series by suitable short connections in such a manner that the air passes through the meter before entering the drill. It is a positive displacement meter, that is, no air can get through it without actually occupying the cylinder space. Air enters the meter through the



CLARK COMPRESSED-AIR METER

connection at the right end, exhausting at the left end and passing on to the drill. In its passage it forces a piston full stroke in alternate directions so that the quantity of air passing per minute will be the volume of the cylinder multiplied by the strokes. The strokes are automatically recorded by a simple counter on the left-hand end, the cover being shown removed in the illustration. Knowing the number of reciprocations and noting the gage pressure as well as temperature of the air, simple calculations quickly give the cubic feet of free air per minute.

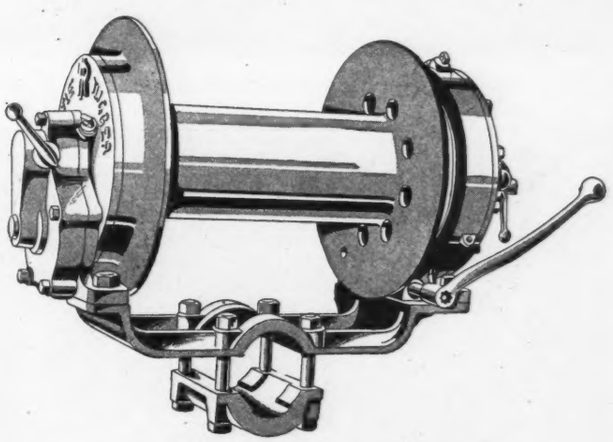
This meter will appeal to operators of properties in which air is furnished to numerous groups of lessees and to company employees where it is desirable to ascertain how the power is being distributed. Another field of usefulness will also be found for it in detecting open lines and leaky pipes.

Portable Railroad to Atbasar Mine, Siberia

Transportation constitutes such an important factor in most mining operations that any new phase of this subject is of interest. The Atbasar mines of the Spassky copper company in Siberia are about 250 mi. from the Trans-Siberian Ry. A new smelting plant and other equipment were to be transported to Atbasar, and it was finally decided to use for this purpose a "portable railway," somewhat similar in principle to the modern track-laying machine. This portable railway has nearly reached Atbasar and in fact would have been there by now had it not been for delays consequent upon the war. Some remarks made in this connection by Chairman Arthur Fell at the recent annual meeting in London are interesting. He said: "The portable railway is about 10 mi. in length, and the amount of goods, trucks and the engines on it weigh several thousand tons. This railway is relaid in sections in front of the train, and by this means the plant is being transported across the Steppes to Atbasar. According to the latest advices the relay rail transport had reached within 40 mi. of the Atbasar mine, and it should have arrived there by August or September. Owing, however, to the men being called up for military service and the fear of the Khirgiz that they would also be requisitioned, all the men who were engaged on this railway disappeared. Some of the labor was got back again with great difficulty and work restarted, but they again disappeared, and I am sorry to report that there is now no prospect of the plant reaching Atbasar this year. I mention this to show you the difficulties of the situation under which we are working the Atbasar mine at 250 mi. from the nearest railway, and the Spassky mine at 500 mi. from the railway.

A New Model Hoist

For the use of those who prefer manila rope to wire rope for light hoisting and hauling, the Ingersoll-Rand Co., 11 Broadway, New York, is making a new model Little Tugger hoist. The square piston, reversible driving engine, automatic lubrication, inclosed gearing, drum-release clutch and worm-operated band brake are essen-



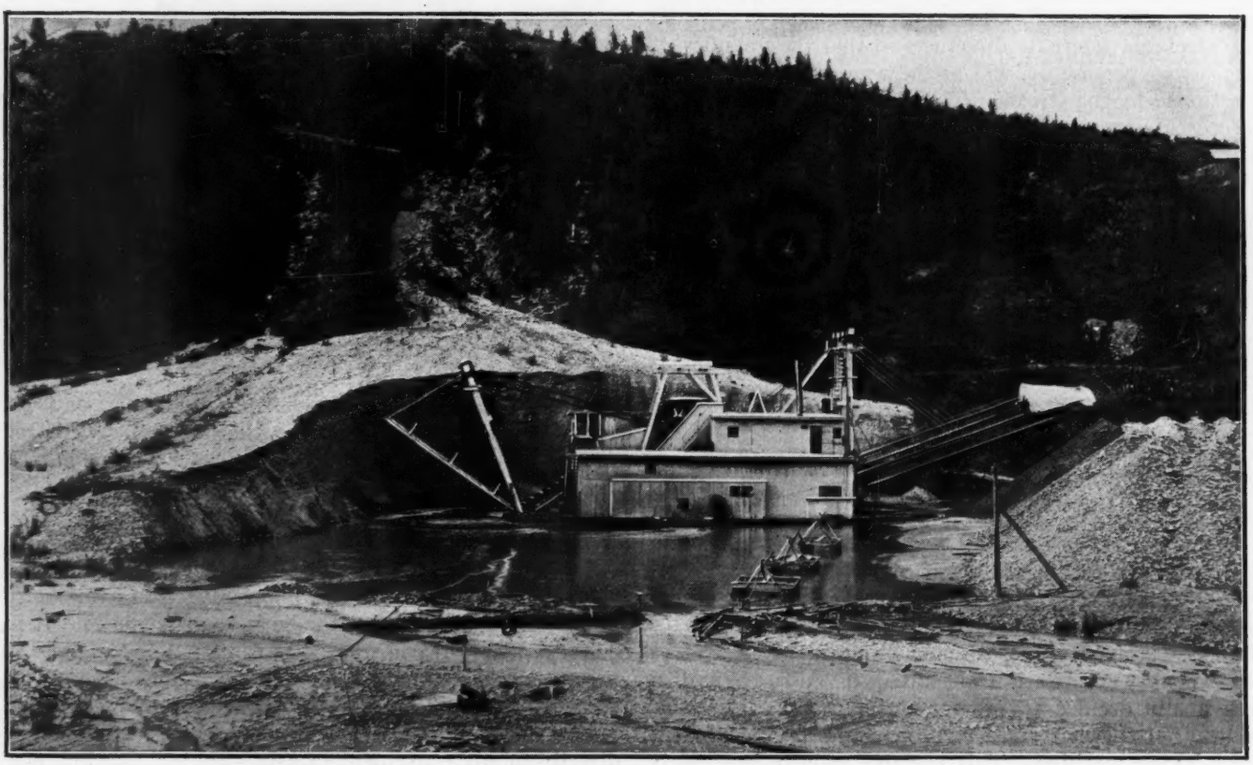
A NEW MODEL "LITTLE TUGGER" HOIST"

tially the same as in the previous model described on page 971, *Engineering and Mining Journal*, Dec. 11, 1915. The main differences are in the diameter and length of the drum, the width of the flanges and, necessarily, the main frame and over-all dimensions.

This new hoist has a drum 7 in. diameter by 17 in. long, with 5-in. flanges. This accommodates 300 ft. of ⅞-in. manila rope. The maximum capacity of this hoist is 600 lb. The weight of the hoist itself is 358 lb. It is 21½ in. long, 31¼ in wide and 23 in. high. The hoist is built for both compressed-air and steam operation. The standard clamp fits a 4½-in. diameter column or pipe, but by removing the clamp the hoist can be readily bolted directly to any convenient support—timber, flooring, etc. Although designed primarily for underground work, it is recommended for general hoisting, hauling and handling in mines, tunnels, quarries and industrial plants.

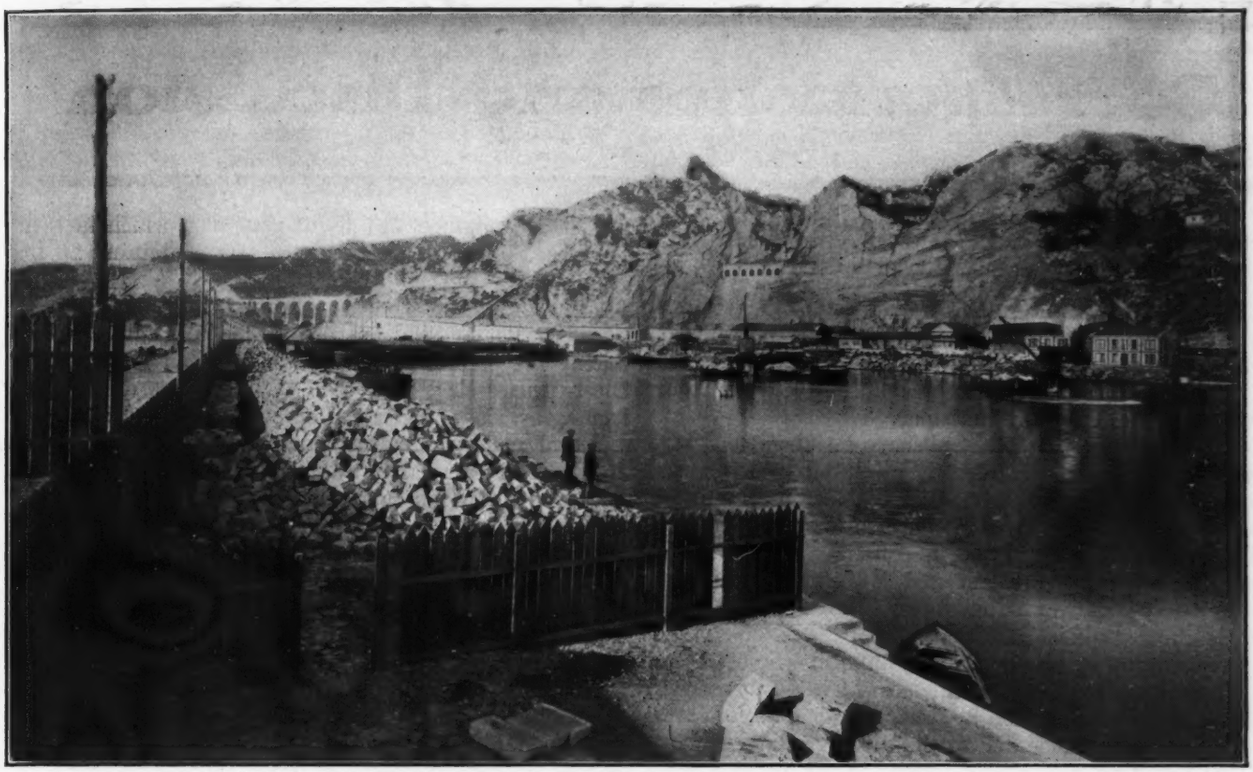
Photographs from the Field

MILL OF NEW YORK & HONDURAS ROSARIO MINING CO., AT SAN JUANCITO, HONDURAS



DREDGING A HIGH BANK OF TAILINGS ON BONANZA CREEK, YUKON TERRITORY, CANADA

The Yukon Gold Co.'s No. 2 dredge, near Dawson, Y. T., digging through a high bank of tailings deposited by early miners on one of the Bonanza Creek claims—38 Below on Bonanza. Part of the sluice used by the earlier miners may be noted farther up on the hillside.



Marseilles harbor looking toward the portal of the Rove tunnel. When completed this will form a protected water route between Marseilles and the Rhone River

Removing core of the Rove tunnel, cross-section of which is the largest in the world. It consists of a rectangle 59x15 ft., upon which is superimposed a sector of 41-ft. radius, the center of which is 9 ft. above the bottom. This gives an extreme width of 79 ft. and height of 50 ft. and a 3,250-sq.ft. section. The tunnel was described in "Engineering News" for Aug. 26, 1915, Oct. 21, 1915, and Nov. 30, 1916, and "Le Genie Civil," May 20, 1916

THE ROVE TUNNEL OF THE MARSEILLES-RHONE BARGE CANAL

Correspondence and Discussion

Limestone Precipitation of Weak Copper Solutions

In the *Journal* of Nov. 11 you publish a letter written by E. Gybbon Spilsbury referring to some remarks that I made at the recent meeting of the American Institute of Mining Engineers about precipitating copper from weak copper solutions by limestone.

It seems to me that Mr. Spilsbury misunderstood my remarks, as I did not refer to precipitation by burnt limestone. As a matter of fact, I consider precipitation of copper from solutions by burnt limestone and the subsequent utilization of the precipitate a very difficult and almost hopeless problem, and Mr. Spilsbury is certainly to be congratulated upon having solved this problem under special conditions.

Precipitation by crude—that is, unburnt—limestone is not a reaction that can be carried out as easily in the laboratory as precipitation by lime, but on a larger scale it presents advantages due to the more granular nature of the resulting precipitate, which, in my opinion, are great enough to justify the practical application of the process.

While we were working here at Inspiration on this problem, Dr. L. D. Ricketts told me that he had accomplished the precipitation of copper solutions by limestone after heating such solutions. W. D. Thornton told me also, I believe, that he had had occasion to use precipitation by limestone.

While, therefore, the principle involved is not new, it is not, to my knowledge, carried out anywhere on a practical scale except, of course, by nature, which has used it for millions of years. RUDOLF GAHL.

Miami, Ariz., Nov. 22, 1916.

Lead-Smelting Practice

Replying to A. S. Dwight's criticism of my notes on the St. Louis hearth, I want to say that I did not fail to read his article carefully, and that the remarkable low matte- and slag-fall applies equally to the hand hearth and the mechanical hearth. The amount of gray slag upon which the matte- and slag-fall depends remains the same whether worked by hand or mechanically.

The increased direct lead recovery on the mechanical hearth is entirely due to a reduction in the flue dust and fume produced. The mechanical hearth, by nearly trebling the tonnage with the same labor, places it on a most economical basis for treating lead concentrates containing 70% and over in metal.

Mr. Dwight says that it hardly seems just to compare the slag-fall in the two processes. As a matter of experience, figures prove that on any grades 60 to 68% Pb for the Dwight & Lloyd and 70% for the mechanical hearth, the slag-fall per ton of concentrates is 1,500 lb. to 500 lb. for the mechanical hearth, and the matte-fall 500 lb. to 50 lb. respectively. This is accounted for by the fact that one ton of 70% concentrates on the mechanical hearth produces 584 lb. of gray slag, which in turn produces 500 lb. of blast-furnace slag containing 26 lb. MgO = 5% MgO.

The Dwight & Lloyd mixture must be reduced to 45% Pb, thereby increasing the slag-fall and reducing the percentage of MgO lower than is necessary. Blast-furnace slags with 5 to 6% MgO are daily made from gray slags, while the slag from sintered Dwight & Lloyd material analyzes from 3 to 4% MgO. The double roast will partly overcome this big difference in slag- and matte-fall, but still leaves a comfortable balance in favor of the mechanical hearth.

Mr. Dwight dwells on the slag-fall only—saying nothing about the more important item of matte-fall. The low matte-fall is one of the decided advantages of the mechanical hearth, as the re-treatment of mattes in almost endless cycles locks up lead in byproducts and materially increases the cost.

Leaving the Joplin and Oklahoma high-grade concentrates (75 to 80% Pb) out of consideration, the percentage of high-grade concentrates (70% and over) in southeast Missouri is not so small as Mr. Dwight indicates.

Notwithstanding the large production of flotation concentrates, applicable only to Dwight & Lloyd, Huntington & Heberlein and other sintering processes, the tendency to produce 70% and over concentrates is increasing in this district and represents nearly three-quarters in weight of the entire output.

It has occurred to me that the mechanical hearth should have a place in the silver-lead districts of Idaho and British Columbia on all concentrates 70% and over in lead. While it is true that no tonnage of this grade is made at present, there is no reason why the grade should not be increased to a considerable percentage of the output, rendering the mechanical hearth applicable to a certain amount of concentrates from these important lead districts. HERMAN GARLICHS.

St. Louis, Nov. 22, 1916.

I do not like to appear to dodge a fair discussion of the relative merits of the Newnam mechanical Scotch hearth and the Dwight & Lloyd process as applied to the preliminary treatment of Missouri lead concentrates preceding smelting in the blast furnace; but the fact is, I do not wish to follow up the subject exactly along the lines of discussion laid down by Mr. Garlichs, and I must therefore ask him to pardon me if I decline to make a categorical reply to the points brought up in his letter of Nov. 22.

My review of "Lead Smelting Practice in the United States" in the *Journal* of Oct. 7, 1916, was intended to be purely academic and as nearly impartial in spirit as I could make it, all controversial elements being omitted. If I was compelled to refer frequently to the Dwight & Lloyd process, it was because it enters largely into present practice, but I hope I did not put undue emphasis upon it. On the other hand, my reference to the Newnam mechanical hearth and its future was intended to be

distinctly complimentary and friendly. It has made a good start in the metallurgical world and will no doubt find its proper place in due time. I, for one, wish it all good luck.

Under these circumstances I do not wish to have the entire spirit of my original article altered by being forced to take part in a controversial discussion or by seeming to criticize and belittle a process that I had previously praised. I cannot agree with all of Mr. Garlichs' figures; in fact, I am quite sure that some of them will require revision, but there are no doubt other metallurgists familiar with the facts who can supply them with better taste than I can at this time.

As a matter of fact, I really cannot see that there is any occasion for a controversy over the merits of the two processes in this connection, for Mr. Garlichs admits that in treating Missouri concentrates there is a point of economic division between them, which point is found at about 70% lead. I have accepted his figure as probably correct and have used it in my paper. Each process, therefore, has its own special province in the preliminary treatment of the concentrates before the final smelting, and I cannot see that there is any use in comparing the slag fall or matte fall in two separate cases where the original material undergoing treatment is different and the final smelting is done by separate metallurgists, each using a different slag type, and where it is admitted that each is being treated in the most economical way.

Any data that Mr. Garlichs wishes to publish about the Newnam hearth will, I am sure, be welcomed by metallurgists, and I, for one, shall be glad to contribute to the discussion, but I confess that I would prefer to find myself discussing *his* paper on this particular subject, rather than having such a discussion tacked on my own paper, in which I distinctly tried to avoid making comparisons. ARTHUR S. DWIGHT.

New York, Dec. 4, 1916.

The discussion of Scotch-hearth practice by Herman Garlichs and Arthur S. Dwight, in the *Journal* of Nov. 25, is interesting to me because it brings out in Mr. Dwight's conclusions the limitations of the hearth to 65 or 70% concentrates of not so fine a mesh as flotation material.

Following this discussion, and the saving of the life of the Scotch-hearth practice by the research along the lines of mechanical stoking carried out by the St Louis Smelting and Refining Co., at Collinsville, Ill., first by the Moses movable hearth and mechanical stirrer or stoker, and later by the Newnam stationary hearth, using the stoker and data developed by Moses, it may be of interest to note the recommendations I made at the time the Moses experiments were in process, when I saw that future conditions of treatment involved large proportions of fine lead concentrates running about 50% Pb. I was then acting as research metallurgist for the National Lead Co., conducting tests at the Collinsville plant.

The imperfect action of Dwight & Lloyd roasters on the sulphur of PbS and the inability to treat very fine lead concentrates containing 50% Pb by the hearth reaction, and the successful results I obtained in forming small hard contact briquettes—1 in. or less in cross-section—of lead flue dust, with any fluxes *ad libitum*, led me to suggest a contact reaction for the hearth action. This would undoubtedly precipitate 70 to 80% of the lead, even in concentrates carrying as low as 30% Pb; combine the sulphur with iron from which the hearth action would easily oxidize and remove it; reduce the necessity of a bagroom in large proportion, as the PbS and PbO sublimation would exist only in small degree as compared to the present action; and lastly yield a so-called "gray slag" suitable for blast-furnace smelting.

The only difference would be that the slag would run high in iron-oxide compounds, thus obviating the necessity of adding the flux at the blast furnace. Lime would not be desirable in the hearth mixture, as it is even more tenacious of sulphur than PbS and thus would defeat the desulphurizing act desired.

If the hearth men will adopt this contact-briquette idea, they will handle the fine low-grade lead concentrates more easily and rapidly than they now handle 70% concentrates and with greater yield of metal and less "fume." I agree with Mr. Dwight that the mechanical hearth saved the life of the practice and feel that the use of a contact-briquette reaction, followed by the desulphurizing in the same hearth act, will preserve the hearth practice when 70% concentrates are no longer obtainable. The hearth will thus become a reducing furnace to approach the blast furnace.

The method proposed involves forming a hard-pressed briquette using 50- to 200-mesh concentrates or slimes or flue dust, mixing in iron oxide or scale adequate to form FeS and about 10% pulverized coke as fuel, with 5 to 6% pitch binder. Use a special type of roller press giving 5,000-lb. pressure per square inch. Bake the briquette at 400° to 500° C. and charge as hearth feed. The cost of briquetting was about $1 per ton, including binder. The resulting efficiency would save that amount, but added to this is the ability to handle any concentrate, irrespective of grade or fineness.

The matte fall of the blast furnace can be easily controlled by varying the iron-oxide proportion in the briquette, which practically would be less than the amount theoretically necessary to desulphurize PbS. The perfection of the contact-briquette reaction and their superior action under heat are well known to zinc men in retort tests. Why the St. Louis Smelting and Refining Co. did not avail themselves of the facts I never knew, but conditions will perhaps soon force the issue.

Essex, Mass., Nov. 29, 1916. PARKER C. CHOATE.

Oil-Fired Boilers vs. Hydro-electric Power

In the *Journal* of Oct. 28, 1916, page 787, is described three types of oil-fired boiler installations in Arizona. The average efficiency of these three installations is 80%, but no cost of producing power is given. The Edison power plant at Long Beach, Calif., has shown for that locality that oil-fired boilers produce power at a lower cost than hydro-electric means. This argues well for oil-fired power plants, but I would like to see some cost data for a plant using hydro-electric and oil-fired power plants interchangeably. A plant permitting the economic operation of these two methods of power generation would require a cheap and constant supply of oil fuel and streams capable of hydro-electric development. California should contain localities of this type.

New York, Dec. 1, 1916. F. W. FREDERICKS.

Jerome Mining District Geology*

SYNOPSIS—The ore-bearing Yavapai schist is deeply buried beneath sedimentary strata and lava except for a great belt exposed by erosion along the extent of the great Main Fault. The orebodies of the district are great pipes of which horizontal sections have their main axes within the plane of schistosity. They are characterized by great bodies of gossan capping the ore whether outcropping on the surface where erosion has exposed the schist, or deeply buried by sedimentaries. Since such outcrops could easily be detected within the belt of exposed schist, it is contended that prospecting within the area capped by sedimentaries and lava, which may hide gossan caps, is fully as apt to result successfully.

No general geological study of the Jerome mining district has ever been published. The United States Geological Survey has so far devoted no attention to this section. Since recent mining developments in the district have been so important and have attracted so much attention in the mining world, the following report is issued in the hope that it will prove timely and useful to many operators beginning new work in the vicinity. It is written with the object of aiding the local miner and prospector rather than of benefiting the trained geologist.

Historical Geology of Jerome District

The oldest underlying rock at Jerome is a schist which forms the body of the mountain range. It extends south and westerly into the Bradshaw Mountains, where the United States Geological Survey has examined it and named it the Yavapai schist. As seen on the geological map, Fig. 1, to the north of Jerome this schist underlies all the limestones, sandstones, shales and others that are so prominent in the landscape, and it is found again in the bottom of the Colorado Cañon. The only extensive area where this schist outcrops on the surface is seen on the map extending from just north of the famous United Verde mine in a southeasterly direction, bounded on the northeast by what has been called the Main Fault.

For illustrative purposes the sequence of geological events is outlined in the sketches of Fig. 3.

The Yavapai schist is the result of intense folding and altering of what were at one time flat-lying lava beds and sediments, illustrated by *A*, Fig. 3. In ancient geological time (Algonkian) these lava beds were folded in very tight and almost vertical folds, whose axes took a general northwest-southeast direction at Jerome (illustrated by *B*, Fig. 3).

This intensely folded schist was invaded from below by large diorite dikes and stocks that forced their way up most easily along the planes and cracks which the folding had produced in the beds, as illustrated at *C*, Fig. 3. As a consequence these diorite intrusions also have a northwest-southeast trend.

This mass of folded beds and diorite dikes was then subjected to great pressure and chemical action, probably through being buried once or more under great masses of younger rocks and subsequently uncovered by their erosion. During this period chemical changes, heavy shearing, etc., altered the beds to schist. Into the slips and minor faults caused by this shattering, smaller acid dikes of quartz, porphyry and trachyte were intruded as shown at *D*, Fig. 3, and following the planes of schistosity, also took a northwest-southeast direction.

It was probably at the time of the intrusion of the diorite that mineralization took place, since the siliceous dikes are younger and frequently cut the orebodies.

The period of time during which events so far related took place was pre-Cambrian and more definitely placed as Algonkian.

During the succeeding Cambrian age the schists, eroded to a nearly level surface, were inundated by sea water. Sandy sediments were deposited over the schist to a thickness varying up to a maximum of 90 ft., which formed the coarse red sandstone which is now found nearly everywhere adjacent to the schist. This Cambrian sandstone is named the Tonto sandstone.

During the following Devonian and Carboniferous ages, great beds of limestone were deposited conformably on top of the sandstone, which in places reach a maximum thickness of 850 ft. The Carboniferous limestone was capped by some 300 ft. of sandstone, likewise of Carboniferous age. The condition of the rock strata at this time is illustrated by *E*, Fig. 3.

At the end of Carboniferous time, the country south of Mingus Mountain (Fig. 1) was lifted by earth movements gradually clear of water and the beds bent and eroded as shown at *F*, Fig. 3.

During the comparatively recent time (Tertiary) eruptions of lava, probably from the direction of Flagstaff, covered the whole country about Jerome, as shown at *G*, Fig. 3. Lava was deposited in successive eruptions and hence varies in variety and composition. The thickness of these lavas today, in places, is a maximum of 700 ft.

The last important geological event was the great faulting, shown at *H*, Fig. 3, which, like the intrusions of diorite and acid dikes, took place in a general northwest-southeasterly direction along the planes of schistosity. Subsequent erosion of the surface shown at *I*, Fig. 3, left it in the shape found by the miner today.

Rock Characteristics and Outcrops

The Yavapai schist, as shown in Fig. 1, forms most of the eastern part of a wide belt extending from Jerome to the Copper Chief mine. One of the best schist exposures can be seen near Jerome, just below the Arkansas and Arizona mine, where it crosses the gulch in which the Haynes mine is situated. The schistosity, or lamination, here strikes about N 10° W with a dip of 70° from the horizontal toward the east. This dip and strike persists near Jerome, but in the Black Hills property and at the Copper Chief mine, the strike is almost east-west, owing probably to original folding and crumpling in that direction, and to local granite intrusions.

The schist is a rock of very fine texture, frequently resembling a shale. Its color varies from light to dark greenish gray with a bluish tinge. It almost always has a schistose, or slaty, structure.

The diorite is found showing all gradations from a coarsely to a finely crystalline structure, depending upon

*Abstract from "Geological Reconnaissance of Jerome District," a report by F. A. Provot, mining engineer, United Verde Extension Mining Co., Jerome, Ariz.

conditions of cooling after intrusion. Where sufficiently coarse, it has a mottled greenish appearance, but where its texture is fine and it has acquired a slaty structure through subjection to shearing, it so closely resembles the schist that it is practically impossible for the miner to tell them apart by eye alone.

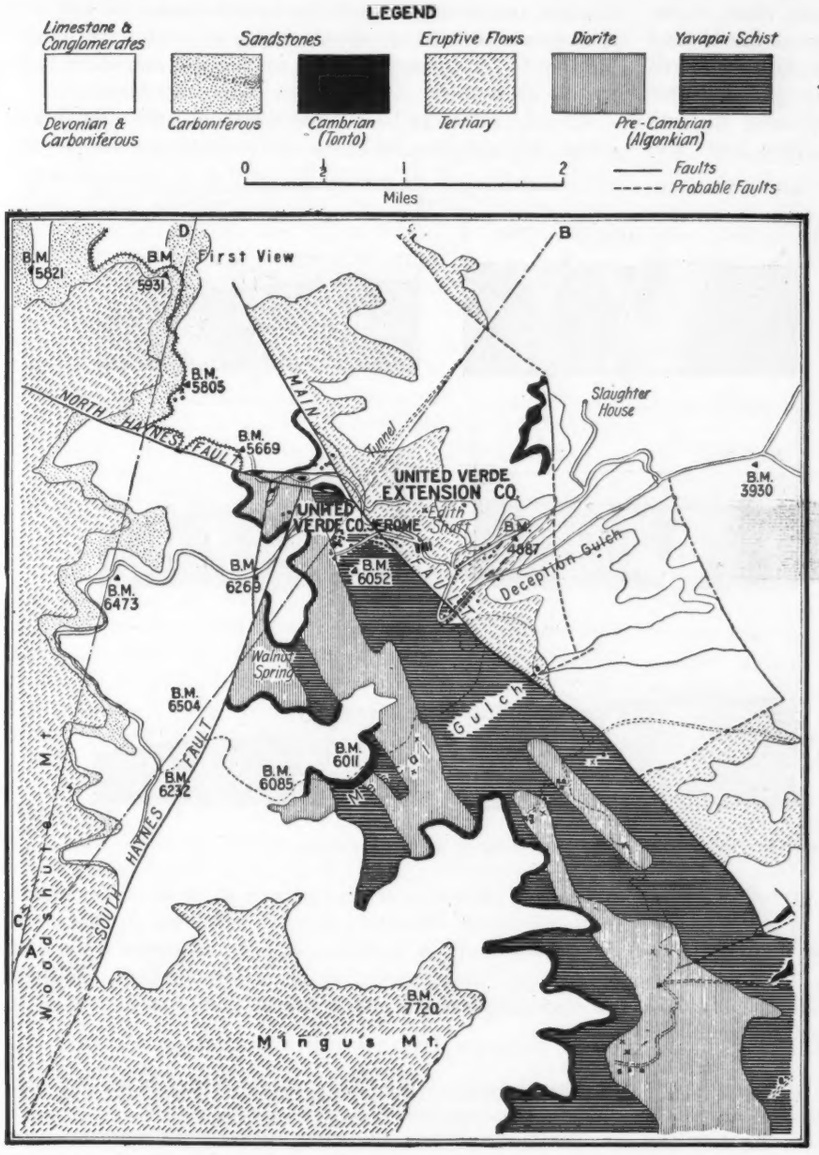


FIG. 1. GEOLOGICAL MAP OF JEROME MINING DISTRICT

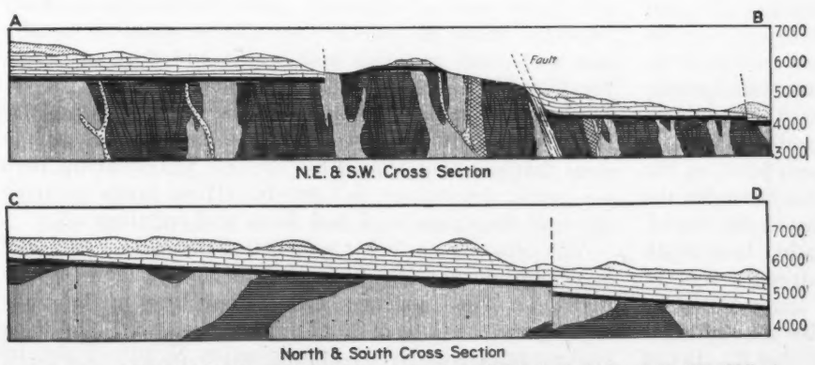


FIG. 2. GEOLOGICAL SECTIONS ALONG LINES A-B AND C-D OF FIG. 1

Great dikes of diorite measured in miles run northwest and southeast along the general strike of the planes of schistosity. The diorite outcrops shown on the map, Fig. 1, are merely sketched in to give an idea of their mode of occurrence. Their accurate outlines can be determined over a wide area only by a thorough and expensive geological survey. A great diorite dike can be seen in the west wall of the big opencut on the surface of the United Verde mine, and it probably runs, with numerous parallel dikes, southeasterly through the range. It can be seen again in the upper part of Mescal Gulch and once more in the Brookshire property and Equator mines. Many other dikes are also found in the schist underlying the limestones on the down-throw side (north) of the great Main Fault. The acid dikes, called watercourses by the miners, are best seen in underground workings. They are frequently associated with orebodies, often cutting the latter, and have had great influence in causing secondary enrichments in the chalcopyrite and pyrite chimneys. The acid dikes are usually grayish rocks, speckled with snow-white feldspars, much altered and kaolinized, especially in the vicinity of orebodies. They are not of great width, usually measured in feet, and generally have the same general trend as the diorites and schist. The Tonto sandstone, colored dark wine-red, lies almost everywhere on top of the schist and diorite, almost flat except where faulted. Beginning directly above the old smeltery of the United Verde Copper Co., it can be traced, as shown on the map, Fig. 1, with only one or two breaks, down the east side of the range past the Copper Chief mine. It is absent in the upper part of Mescal Gulch and for a distance south of the Pittsburg & Jerome mine. To the east of Jerome only two exposures are known to the writer—one by the lower ore bins of the United Verde Extension Co., at an altitude of about 4,350 ft., and another just below the Copper Chief mine, at about the same altitude. This great difference in elevation between its position on the west side and that on the east side of Jerome (about 1,600 ft.) gives with considerable accuracy the throw of the great fault to which the name of the Main Fault has been given. By careful study of the position of this sandstone, the miner can usually foretell the thickness of overlying lava and limestone through which he will have to sink a shaft before reaching the underlying ore-bearing schist. The other overlying strata of limestone, sandstone,

conglomerates and lava have no particular interest to the miner. No secondary deposits of ore of any importance have as yet been found in them, and there is little likelihood of any being so found as the strata were laid down long after the ore was in place.

A study of the three large known orebodies of the district—namely the United Verde, the United Verde Extension and the Copper Chief—shows that the crest of the orebody, whether exposed on the surface as at the United Verde or covered by limestones, as at the United Verde Extension, was constituted by a large quartz and gossan outcrop. In each case the original mineral, through oxidation, has left on the schist surface very large and unmistakeable indications of the great orebodies found below. At the United Verde Extension mine these siliceous croppings happened to be covered by Cambrian sandstone and limestones, below which they oxidized. Were these strata removed, however, similar croppings to those at the Copper Chief and United Verde mines would be exposed.

All the large orebodies occur typically as enormous pipes or chimneys of lenticular cross-section measured in hundreds of feet. Their form can best be vizualized by comparing them to flattened cigarettes standing almost vertically. A cross-section of an orebody always has its longer axis paralleling the planes of schistosity of schist or diorite in which it is found, and the dip of the ore also follows this schistosity. Cracks in the nature of veins often extend from the ore pipes in a northwest and southeast direction.

The primary ores were chalcopyrite, bornite, and pyrite in a siliceous gangue, with such a preponderance of the first two minerals as to make these orebodies probably the highest-grade large copper-sulphide mines of the world.

Oxidation in the upper levels has extended to a depth of from 150 to 400 ft. and here has produced a zone of enormously enriched ore, the enrichment being caused by secondary chalcocite or copper glance. This zone of great enrichment reaches in places a thickness of 200 ft. Below it the original primary ores are found still of very high tenor, and these primary ores show even to great depth numerous zones of relative barrenness and enrichment.

Below the surface capping, or gossan, previously described, the oxidized zone consists of siliceous sands containing certain values in gold and silver that in some of the mines are of considerable economic importance. Certain associated minerals have occasionally formed concentrations in the oxidized zones so that occasionally bunches of secondary lead ores, manganese and other rarer metals are found. These are of little importance.

The ore seems to be a replacement of both diorite and schist, perhaps brought about by the solutions that accompanied the intrusion of diorite, and at or near its contact with the schist. Nothing positive is known on this point. Perhaps a study by the Government may throw some light on the origin and manner of ore deposition. Without further data speculation on the subject is idle.

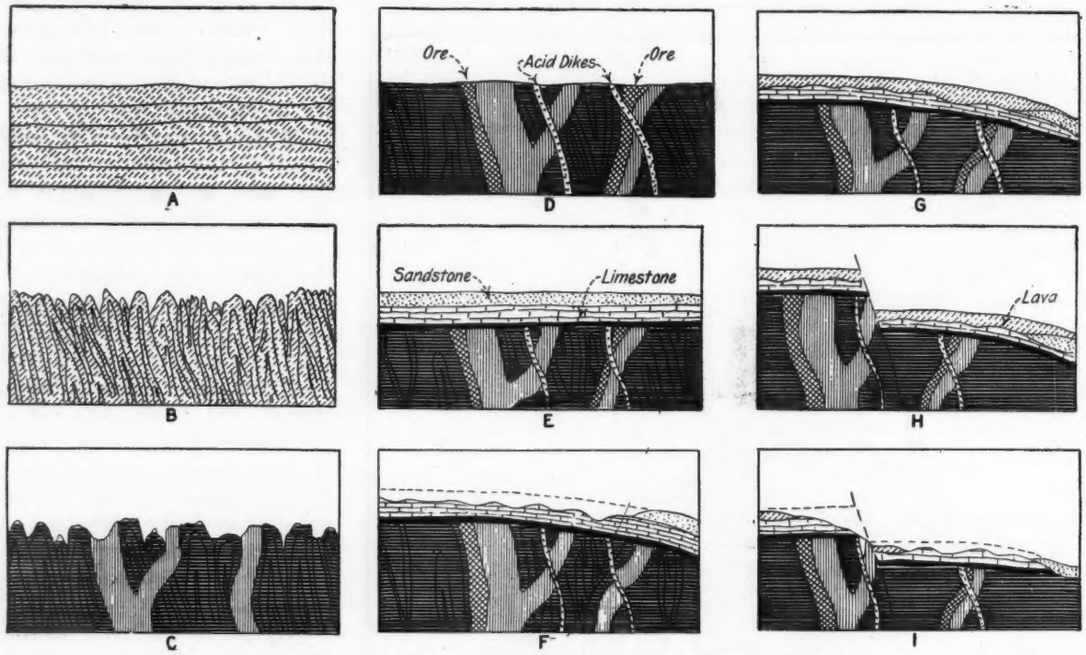


FIG. 3. SEQUENCE OF GEOLOGICAL EVENTS SHOWN GRAPHICALLY

District Faulting and Principal Faults

Two periods of faulting are recognized in the district, which are separated by ages of geologic time.

The first faulting, occuring during pre-Cambrian time, faulted the schists, diorites and inclosed orebodies, but not the overlying sedimentary strata and lavas. These old faults were of relatively small displacement, rarely having a throw of over 100 ft. Their course is usually east and west or north and south, and they no doubt provided pathways for some of the acid dikes.

The important faulting took place during comparatively modern time—post-Tertiary—and caused tremendous displacement, the throw at one place having been accurately determined as 1,600 ft. These faults occurred after all the strata were laid down and cut them all.

The principal fault has been called the Main Fault, and is locally known as the "lower contact." As shown by the map, Fig. 1, this extends beyond First View to the north and beyond the Copper Chief mine to the south. While its strike varies slightly, it approximates N 40° W for its

whole course. Its throw at Jerome is 1,600 ft., and all the country to the east has dropped for that distance. The dip of the fault seems to vary considerably. At Jerome it is probably 65° below the horizonal, and it seems to get steeper with depth.

On the surface this fault is easily traced by following the line of contact between the lavas and limestones with the schist belt. Underground the fault shows as a badly shattered zone from 80 to 200 ft. wide.

Two other large faults have been named by the writer, the South Haynes Fault and the North Haynes Fault. The former fault is seen on the map, Fig. 1, extending from the summit between Mingus and Woodshute Mountains to an intersection with the North Haynes Fault. All the country to the west of the fault has dropped about 350 ft. in two steps.

The North Haynes Fault runs almost east and west through Haynes Gulch, starting at the Main Fault, south of the United Verde "glory hole," then passing just below the railway station and continuing up the first gulch just north of the Haynes shaft. The country north of this fault has dropped from 300 to 400 ft. below the country to the south.

Summary for Practical Mining

The orebearing complex underlies the sedimentaries, and therefore the ground under the limestones and lavas is good prospecting country—perhaps better than where the schist has no capping, for the limestone may hide gossan croppings that would otherwise show on the surface. Seeking for the cropping of an orebody under hundreds of feet of limestone is, of course, rather blind prospecting, but the history of the United Verde Extension find under such circumstances will no doubt stimulate prospecting.

For the operator and underground man the important fact to bear in mind about the schist is that the strike of shistosity planes at Jerome is about N 10° to 20° W, and the dip about 70° to the east from the horizontal. All prospecting should therefore be done as much as possible by running long drifts along the strike of the schists, and numerous crosscuts run from them at right angles. Acid dikes encountered underground should be followed, as they have been found in practice to lead to orebodies.

Chronology of Mining for November, 1916

Nov. 1—All Australian coal mines at Newcastle and Maitland idle on account of strike, about 12,000 employees being affected.

Nov. 2—Anaconda bought Lexington mine at Butte, Mont., and other claims of Atlantic Mines Co. in northern section of district.—End of labor strike, begun Sept. 19, at Mother Lode mines in Amador County, California, the miners returning to work on the old basis.

Nov. 6—Nevada-Douglas Copper Co. started its main leaching plant at Ludwig, Nev.

Nov. 13—Carranza extended forfeiture date for idle Mexican mines 60 days to Jan. 14, 1917.

Nov. 15—Exploration Co., Ltd., reduced capital from £750,000 to £375,000 on account of depreciation of its Mexican investments.—Arizona Copper Co. resumed operation after 11 days' idleness due to strike resulting from discharge of Mexican employee for sleeping while on duty.

Nov. 17—Suit filed in New York Supreme Court by 15 fire-insurance companies to prevent collection of damages by Tennessee Copper Co. for destruction of its Fox Hill trinitrotoluol plant.

Nov. 23—Tentative agreement for consolidation of the McIntyre, McIntyre Extension and Jupiter properties in Porcupine district, Ontario, adopted by directorates at joint meeting in Toronto.

Nov. 26—Yuba No. 16 all-steel dredge launched near Hammonton, Calif.

Nov. 28—Transfer of management of Tennessee Copper Co. to Tennessee Copper and Chemical Corporation, with Adolph Lewisohn and associates in control.—Judge Bourquin, of Federal District Court at Butte, Mont., denied petition of Minerals Separation, Ltd., for injunction to restrain Butte & Superior Mining Co. from paying dividends and Butte & Superior was released from its $75,000 bond previously ordered for possible patent infringement.

Foreign Trade in Copper

Exports of copper from the United States in October are reported by the Department of Commerce as follows, in pounds:

Ore concentrates, contents	1,174,695
Unrefined, in bars, etc	4,653,542
Refined copper in ingots, bars, etc	55,303,187
Old and scrap	329,200
Plates and sheets	971,953
Wire	2,280,505
Total copper	64,713,082

The weight of ore exported in October was 16,800 tons; of concentrates, 725 tons.

Imports of copper into the United States in October are reported by the Department of Commerce, as follows, in pounds:

Ore concentrates, contents	12,373,571
Matte contents	713,919
Unrefined, in bars, pigs, etc	14,731,276
Refined in bars, plates, etc	5,782,771
Old, etc., for remanufacture	939,792
Composition metal, copper chief value	36,596
Total copper	34,577,965

Actual tonnage of copper-bearing material imported in October was 45,172 tons ore, 13,279 tons concentrates, and 789 tons matte.

May Withdraw Oil-Shale Lands

Secretary Lane recently recommended to the President the withdrawal for navy reserves of about 45,000 acres of public land in Colorado and 86,000 acres in Utah, each of which, it is estimated, will yield not less than 500,000,000 bbl. of fuel oil. The lands include a part of the Green River formation, containing shales that yield petroleum when subjected to destructive distillation. Shales of this character in Scotland have long been producing oil and paying dividends on a large investment. The shales in the areas withdrawn will yield from two to four times as much oil as is obtained from the average ton of Scotch oil-shale. In addition to the heavy residuum, this shale oil will yield 10 to 15% of gasoline by ordinary methods of refining, and as a byproduct the shale will produce ammonium sulphate, a valuable fertilizer, in large quantities. The lands lie within easy reach of railroad lines and will, it is believed, be exceedingly valuable as an underground reserve fuel for the navy. In addition to the areas withdrawn there are other large unreserved areas of lands containing this shale.

Editorials

Enter the Federal Bank

The recent actions of the Federal Reserve Bank are considered by some thoughtful persons to be momentous, to mark a new development in American finance, and there is good reason to concur with that opinion. Heretofore American finance has been of the happy-go-lucky order. Bankers have acted individually and done as they would. Excesses have been committed, the natural consequences have ensued, business has paid the penalty and when banking has been manifestly sick—and not until then—the doctors, alias the more conservative financiers, have been called in to effect a cure. The policy of the Federal Reserve Board—and in exercising this it is possibly exceeding what was contemplated by its creators—is obviously to prevent illness. That there should now be such a power acting for the collective interest of all the people, without fear or favor of any group, is the new and wonderful thing in our financial history.

The recent warnings of the Federal Reserve Board have been but imperfectly understood, but the ensuing events, which happened with dramatic promptness, did much to clarify them.

The great accumulation of gold in the United States, the inflation arising from it, has been recently more and more the subject of discussion. Alarm over the prospect has been freely expressed. The public was therefore rather startled to hear a few weeks ago that the Federal Reserve Board did not see necessarily in this any ground for alarm. The public generally overlooked the proviso accompanying this assurance, which was to the effect that there was no ground for alarm if the situation were properly handled, and by proper handling was signified the impounding of the gold. The coolness of the Board reflected its plain intimation that it intended to see to it that a good deal of the gold should be impounded, by obtaining legislation, if necessary, requiring the banks to pay in next spring what is not due by present law until next fall.

The next step of the Board was the issuance of a note of warning against the floating of British treasury bills among our bankers. Again this was misunderstood. It did not mean to cast any aspersion upon British credit, nor did it mean that American investors should not subscribe to foreign loans. It meant simply that American banks should not tie up their funds in bills of apparently short-time which might, however, prove easily to be long-time. Rather should surplus funds be kept surely liquid for the commercial uses of this country. The proposed issue of British treasury bills was promptly withdrawn, in spite of the prognostications of some powerful bankers that it would mean a curtailment of foreign buying of our commodities, and the selling of American securities, etc.

The next dramatic events were a poor bank statement last Saturday and a rise in the rate for call money to 15% last Monday. For many months the call money rate had been about 2% and the common theory was that money had been plentiful, was plentiful and would continue to be plentiful. The first part of this theory was correct, the second was incorrect, the third is still veiled in the mystery of the future. In fact the situation has been tightening. We look back upon recent bank statements and see it. But we did not see it when they were current. The Federal Reserve Board is making it its business to see such things and remind us of them. Hence its warning about the British treasury bills.

But why this talk of dearer money? We were all under the impression that the United States had been making more than it knew what to do with. What has become of it? Well, we have tied up large parts of our liquid resources in foreign loans and in the erection of new plants at home. A vast sum of money is absorbed in Wall St. speculation. Present conditions require far more money for carrying on commercial business than ordinarily. We must not delude ourselves with the idea that great profits and high prices spell security. In 1873 prices were very high but there was a panic. In the early part of 1907 prices were high and profits were large. The first signals of danger in 1907 were little spasms of tight money, disappearing and recurring, each time a little worse. Commonly these are dismissed as trifling "flurries," just as the man who is getting sick ignores premonitory headaches. Last July there was some tightening of money. It recurs about five months later. This does not mean that we are going to be sick, but the Federal Reserve Board warns us that we may be if we do not take care of ourselves.

This Is Not a Wild Cat

The *Engineering and Mining Journal* does not advertise mining stocks or promotions, but we have broken our rule, and are not only advertising a mining promotion, but are doing it in our editorial pages. Moreover, the "interests"—these particular "interests"—have got us. We are ready to do anything they want us to do. We are not ashamed of it. "Belgian Kiddies, Ltd." is organized under the laws of humanity. The promoters do not say anything about the stock quadrupling in value during the next month or two, and they state specifically that it will never pay any dividends. As to the latter, we are not so sure as they are. We think it will pay big dividends in friendliness and in the satisfaction that every subscriber will feel from having done a good deed.

"Belgian Kiddies, Ltd.," is being promoted by American mining engineers as a testimonial to Hoover and his great work in relieving the Belgians. There has been a lot of talk about doing something to show Hoover what we think of him, and how we appreciate the honor that he has done to the mining engineering profession. But Hoover does not need medals, loving cups, or diplomas. He has got more of them than he can remember. We had been a good deal at a loss to know what to do for Hoover until he, himself, unconsciously indicated it.

Hoover wrote over a few days ago that the Belgium Commission needed a lot more money in order to feed

the Belgian children especially. His medical experts had reported that there was an alarming increase among them of tubercular tendency, etc., owing to insufficient nutrition. If the Belgian race is to be perpetuated it is necessary that the children shall have at least one square meal per day and for a long time. This news inspired the idea of giving Hoover a Christmas present, which we knew he would accept, for he would accept it only as a trustee, and would turn it over to the cause nearest his heart. What the mining engineers are going to do is, we hope, only a beginning.

The Belgian Commission has so far expended about $227,000,000 in support of the Belgian people with an administrative cost that is ridiculously low. There never was any charity in the history of the world run on such business principles. That was due to Hoover.

For supporting the Belgian people, the American people are regarded by the Belgians as their great benefactors. That also is owing to Hoover, who in the eyes of the Belgians constitutes the American people. In fact, the United States has contributed only about 4% of the money that has gone to the Belgians. Consequently, we have been sailing under false pretences, have been four-flushing, etc. We owe it now to Hoover to make good. In making good it is appropriate that the mining engineers should lead the way, for Hoover has done more than anybody else to advertise them by showing what a leading mining engineer really is.

We urge our readers to send in their contributions. This is not a case of partisanship, or of any exhibition of feelings pro-ally, or pro-German. It is simply a case of relieving suffering humanity, and especially the helpless part of it. Just incidentally, we shall please Hoover.

A Christmas Appreciation

This has been a prosperous year for the mining industry, perhaps the most profitable it has ever experienced. The high price of the metals has been a stimulus to record production and a comfort to shareholders. But to the operating staff 1916 has been a strenuous year; feverish production has been demanded; labor has been more scarce and independent than ever before, and delivery of machinery and supplies equally difficult.

The members of the operating staff have given unstintingly of their energies and have strained every resource in keeping the output up to the maximum. They have had their eyes constantly focused on production and have not given much thought to next year or to the period when all the refinements of practice will be required in order to bring costs within the limits that will be set when metal prices again become normal. The staff members—from shiftboss to superintendent—have been working at high pressure during this extraordinary period, and under the most trying operating conditions have produced record outputs in nearly every instance. Has it been appreciated?

We believe that every manager is deeply grateful to his staff for the loyal service that has been given both in and out of regular hours. But do the members of his staff know this? To be sure, there have been bonuses but these have been well earned and lack the personal element necessary in the expression of individual appreciation of the directing head for this loyal coöperation. How, then, is the manager to show his appreciation?

May we suggest that a subscription to the *Engineering and Mining Journal* would be the ideal Christmas gift for this purpose. It will not be broken, burned, or eaten during the first succeeding week, as are most other gifts. but will be to each recipient a weekly reminder throughout the year of the thoughtfulness and appreciation of the directing head of his company, and as such will receive careful reading. Instead of having to take chances on a hasty perusal of the office or club copy, the recipient will have the *Journal* at his home or room, where he can look it through at leisure and benefit by the opportunity to read with care the many valuable contributions to technical literature that appear in it during the year. This will be of advantage not only to himself, but likewise to his company, because many suggestions are constantly appearing as to different ways of doing things that might be applicable to local operations and help to solve that ultimate problem of reducing costs which is awaiting all company heads following this period of war prices. We can call to mind nothing that would stimulate more thinking on the part of the operating staff or would be more appreciated than a personal copy of the *Journal* that the recipient can clip or file as best suits his purpose.

Any manager or superintendent who may desire to express his appreciation of the work of any members of his staff in this way can do so by simply mailing our subscription department a check and the list of names to which he desires the *Journal* to be sent.

The remaining issues of December will be mailed to each, together with a special Christmas card (or letter) announcing that the *Journal* is to be sent to him during 1917 with the compliments of the manager or superintendent of his company.

The United States maintains a Bureau of Foreign and Domestic Commerce and is going to the expense of sending representatives to far-off lands of South America, Australia, China and Russia to find opportunities for foreign trade and investment, but already-established investments in Mexico may go to pot because Mr. Bryan blandly declared these foreign investors to have been mere adventurers and their capital and property entitled to no protection. What is to be done with this new foreign trade when we get it? Is it also to be cast overboard? It is safe to say that we would not now need to bother about America's foreign investments had it been foreseen that the time would ever arrive when American property would not be protected by its Government to the full extent to which it was entitled.

Some real measures are being taken to increase the spelter production of Great Britain, and three important additions to plant there are now going up. A small works is nearing completion in Italy. The new plant at Ehibastus, Siberia, is reported to have gone into operation. Steps are being taken to increase the production at Port Pirie, in Australia. In the meanwhile the Japanese are making great strides in spelter production. Their output in 1916 is expected to be about 25,000 tons, against about 17,000 in 1915. In 1915 Japan for the first time became an exporter of spelter, sending out 5,300 tons. The record of all foreign countries in spelter production is, however, rather petty in comparison with that of the United States, which has doubled its output—already large—in less than two years.

$120,000

Preferred Stock, Health Giving and Life Saving

Belgian Kiddies, Ltd.

(A Corporation to be organized under the laws of Humanity)

10,000 shares of a demand value of $12 each

Registrar—None* Trustees—Hoover, Honnold & Co.

*"Let not thy left hand"

We offer, subject to no over-subscription or prior allotment, $120,000 preferred stock, and as much more as we can get rid of, in Belgian Kiddies, Ltd., concerning which we are in receipt of full reports from H. C. Hoover, W. L. Honnold, Edgar Rickard, and other well known mining engineers, which we summarize as follows:

I. **The object of this stock issue is to provide one meal per day for ten thousand Belgian children for the year 1917. Each share sold means 365 square meals for one child.**

II. **Our business is constantly growing and no estimate can be made of the requirements for 1918.**

III. **Security of the principal is absolutely assured by the personal management of H.C. Hoover and associates.**

IV. **That no cash dividends will ever be paid is absolutely guaranteed.**

V. **The stock is probably only part paid and is fully assessable.**

VI. **The stock is preferred as to holders, the subscribers being preferably taken from the members of the mining and metallurgical professions, and their wives and sisters.**

VII. **The demand value of the shares shall be $12, preferably payable in advance, but installments will be welcome if more convenient to the subscriber.**

The legality of this issue has been passed upon by no one, but the committee can convince any one of its necessity.

Applications for stock, should be mailed at once as we desire to sell the allotment before Christmas.

Address Subscriptions to

BELGIAN KIDDIES, Ltd., *Room* 2124, **120 Broadway, New York City**

Belgian Kiddies, Ltd.

The promoters of this movement have issued the subjoined explanatory letter. Checks (or money orders) should be made payable to Herbert C. Hoover, Chairman, Room 2124, No. 120 Broadway, New York.

Dear Sir:

An informal committee of mining engineers from all over the United States, are undertaking to give our friend Herbert C. Hoover a Christmas present, by taking off his shoulders part of the burden which he and his associates have been carying for the last two years and a half.

During this time, the United States has received a great deal of gratitude from the Belgian people which it has not deserved. To the Commission for Relief in Belgium all praise is due for their work. The C. R. B.—as it is known—has distributed in Belgium goods costing about $227,000,000, of which the United States has contributed $10,000,000, or about 4.3% of the total; and much of this has come from a few large foundations. The commission has purchased in the United States goods to the amount of $125,000,000. We have not even paid a fair commission thereon. Reduced to a per-capita basis, we have given 8 cents apiece. Canada has given 18 cents per capita, New Zealand $2.34 and little Tasmania $6.25 a head. Yet the United States gets most of the credit. We have been obtaining gratitude under false pretenses.

This is naturally discouraging to us who know and appreciate the work of American engineers in Belgium. These men have been keeping alive a population of nine million on one meal a day. This is not enough for children. (Would you like it for yours?) At present one million children are failing in health, and the C. R .B. has asked us Americans to assume the proper feeding of these children as our little share of the big job.

To do this right, the C. R. B. has started to give the children a nourishing noon-day meal, and they have not the money to carry it on. This costs only one dollar per month per child (three cents a day). This seems incredible but as the overhead expenses of the C. R. B. are only ¾ of 1% of the gross cost you will understand that this is real engineering efficiency.

As engineers we want to show our appreciation and so we have organized an informal syndicate to float a new venture. We would like to cable Hoover before Christmas that we will take a block of "Belgian Kiddies" off his hands. Don't you want to come in with us on this?

Sincerely yours,

BASSETT, W. H.
BRADSHAW, FREDERICK
BROWNE, ROSS E.
BROWNE, DAVID H.
BRUNTON, D. W.

CARNAHAN, R. B.
CATLIN, R. M.
CHANNING, J. PARKE
CLARK, A. C.
CLYMER, F. H.

DOUGLAS, WALTER
DORR, J. V. N.

DRINKER, H. S.
DU PONT, T. C.

EASTON, S. A.

GOODALE, C. W.
GREENWAY, J. C.

HIXON, H. G.
HOLDEN, R. J.
HOLLIS, C. B.
HUNT, R. W.
HULST, G. P.

INGALLS, W. R.
JENNINGS, HENNEN
JACKLING, D. C.

KELLY, WILLIAM
KIRBY, E. B.

LAKENAN, C. B.
LYON, D. A.

MAC CARTHY, J. F.
MAC DOWELL, C. H.
MAC FARLANE, D.
MAC NAUGHTON, JAMES
MATHEWSON, E. P.
MEMMINGER, C. G.
MERRILL, C. W.
MILLS, C. E.
MOORE, P.. N

MUDD, S. W.

NORRIS, R. V.

PARMELEE, H. C.

RAND, C. F.
RALSTON, J. C.
RICHARDS, F. B.
RICHARDS, R. H.
RICKARD, T. A.
RICKETTS, L. D.
RIORDAN, D. M.
ROBERTS, MILNOR

ROBINS, T.

SAUNDERS, W. L.
SMITH, E. A. C.
SMITH, F. M.
STEARNS, T. B.
SULLY, J. M.

VAN HISE, C. R.

WEBSTER, WM. R
WHITE, I. C.
WHITLEY, C. W.
WINCHELL, H. V.

YEATMAN, POPE

BY THE WAY

The *Evening Post* is authority for the story, which is sufficiently plausible, that one large copper company, whose mine is on a mountain, cannot bring its coal up for its plants. The only thing to do is to have the power transmitted by electricity. As the engineering problem has been worked out, the power is to be brought up the mountain through heavy copper conductors raised high from the ground on steel supports. But the copper company not only finds it next to impossible to get the steel for the supports, but is having difficulty in getting the copper wire. It applied to a large copper-wire house to see if it could buy the wire, and the wire house replied that it could not—unless the copper company furnished it the copper. The copper company is now doing this, and it has been compelled to take its copper from its own deliveries in order to do it.

⁂

The Morenci Miner's Union has a new idea in settling strikes. It seems to blend the elements of Christian Science and mediation into a happy harmony, the principles of which when applied to labor disputes bring peace and provide jubilation alike to both the victor and the vanquished. The basic tenet of the new scheme is to the effect that if one tells himself and everybody else with sufficient emphasis that one's opponent has conceded the point, then the point is conceded. On the morning of Nov. 15 the employees of the Arizona Copper Co., who had been on strike because, among other things, the company refused to pay a Mexican for the time he had been laid off, returned to the mine and informed the bosses that, as they had been granted everything they had asked for and Juan had the *dinero* in his pocket, they were ready to go to work, so to work they went. A few days later, Joseph Myers, of the Department of Labor, who sat in the last deal of mediation, sent a letter to the *Clifton Mining Journal* stating that neither the company nor he nor anybody else had paid any Mexican anything for any lost time whatsoever. So the matter stands, and the Arizona Copper Co.'s output is normal. Whether the union or other interested parties secretly paid Juan is not interesting.

⁂

A Yaqui Indian of about 6 ft. 4 in. vertical dimensions came up from Sonora and got a job in a Morenci mine. So patent was his innocence of everything pertaining to mining, the foreman felt that to let him go underground alone would be nothing short of a crime against humanity. So he personally conducted the savage to the stope. He showed the Indian the chute and a pile of ore and explained to him that, as his education in mineralogy apparently had been neglected, the sorting of ore would not come within the scope of his present activities, which same would be merely to transfer the "metal" to the chute. Thus saying, he handed the Yaqui a shovel and pointed to a wheelbarrow. This caused an investigation. The new employee examined thoroughly in turn the chute, ore pile, wheelbarrow and shovel. After a few minutes' work of this inquisitive character, he arrived at the conclusion that there was some relation between the wheelbarrow and shovel and the carrying of the ore to the chute. Accepting this as a working basis, he made a few passes at the ore with the shovel, finally landing a lump in the barrow. After which he finished filling the *carucho* with tolerable efficiency. But then came the nut. How to get the ore out of the wheelbarrow and into the chute was too much for the primitive mind. He made a second round of investigation, but to no effect. He was about to give it up when there came from the direction of the foreman a roar, which, although it has no printable equivalent in the English language, if liberally translated, meant, in addition to a great many things of a personal nature, that it was entirely appropriate for ore to be passing into the chute at that particular hour. *"Si, Senor, muy bien."* Slamming his sombrero to the floor, the Yaqui went down and embraced the wheelbarrow, lifted it and contents to his full stature, walked across the stope and deposited it bottom side up crosswise of the chute. *"Alli esta!"* Needless to say, therefore the Indian won the prize, a few months later, at a single-jack drilling contest.

⁂

November Mining Dividends

Dividends disbursed in November, 1916, by 28 United States mining companies making public reports amounted to $12,111,586, as compared with $6,032,264 paid by 27 companies in November, 1915. Iron, metallurgical and holding companies allied to mining paid $7,887,789, as compared with $7,393,143 a year ago. Canadian and Mexican companies paid $1,941,798, as compared with $1,057,607 in November, 1915.

United States Mining Companies	Situation	Per Share	Total
Am. Zinc, Lead & Sm., pfd., l.s.	U. S.	$1.50	$144,840
Anaconda, c.	Mont.	2.00	4,662,500
Arizona Copper, preference	Ariz.	...	53,840
Boss Gold Min., g.s.	Nev.	.02	8,240
Bunker Hill & Sullivan, l.s.	Ida.	.50	163,500
Bunker Hill Con., g.	Calif.	.02½	5,000
Caledonia, l.s.c.	Ida.	.03	78,150
Champion, c.	Mich.	6.40	640,000
Chief Cons., s.g.l.	Utah	.05	44,148
Cresson Cons., g.	Colo.	.10	122,000
Derry Ranch (old Dredge	Colo.	10.00	10,000
Ducktown, Sulphur, Cop., c.	Tenn.	.33	65,934
Golden Cycle, g.	Colo.	.02	30,000
Hecla, l.s.	Ida.	.15	150,000
Homestake, g.	S. D.	.65	163,254
Intermountain, c.	Mont.	.005	8,250
Mass Con., c.	Mich.	1.00	100,000
Miami, c.	Ariz.	1.50	1,120,671
Nevada Wonder, g.s.	Nev.	.10	140,839
New Jersey Zinc	U. S.	9.00	3,150,000
Pacific G. M. & M. g.	Utah	.01	4,000
Pacific Mines Corpn.	Calif.	.01	6,420
Shannon, c.	Ariz.	.50	150,000
United Verde, c.	Ariz.	1.50	450,000
United Verde Ex., c.	Ariz.	.50	525,000
Wilbert, l.s.	Utah	.01	10,000
Yellow Aster	Calif.	.05	5,000
Yellow Pine	Nev.	.10	100,000
Iron, Metallurgical and Holding Companies	**Situation**	**Per Share**	**Total**
Cambria Steel	U. S.	$0.62½	$562,500
Crucible Steel, pfd.	U. S.	2.00	500,000
Gulf States Steel, 2d pfd.	U. S.	1.50	46,681
Internat. Nickel, pfd.	U. S.	1.50	133,689
St. Mary's Min. Land	Mich.	2.00	320,000
U. S. Steel Corpn., pfd.	U. S.	1.75	6,304,919
White Knob, pfd.	Calif.	.10	20,000
Canadian and Mexican Companies	**Situation**	**Per Share**	**Total**
Amparo, g.s.	Mex.	$0.05	$100,000
Coniagas, s.	Ont.	.25	200,000
Granby Cons., c.	B. C.	2.00	299,970
Greene-Cananea, c.	Mex.	2.00	976,828
Hollinger, g.	Ont.	.05	240,000
Standard Silver Lead, s.l.	B. C.	.02½	50,000
Temiskaming, s.	Ont.	.03	75,000

The dividend of the Boss Gold Mining Co. was initial and the Shannon payment was the first since 1913.

The Atlantic Mines Co., whose property was sold to the Anaconda Copper Mining Co., paid on Nov. 29, a final liquidation of $12.50 per share.

The totals for the first eleven months of the year are as follows: Mining companies, $159,434,606, as against $61,012,688 in 1915; iron, metallurgical and holding companies, $102,884,452, as against $76,638,095 in 1915; Canadian, Central American and Mexican mines, $19,251,679, as against $8,499,315.

Personals

J. D. Spen has removed to Jerome, Ariz., from Oatman.

E. G. Spilsbury has returned from a professional visit to Cuba.

Albert G. Wolf has gone to Cripple Creek on professional business.

Heath Steele has returned to New York from an examination trip in the West.

Adolph Lewisohn has been elected president of the Tennessee Copper Co., succeeding Utley Wedge.

William D. Blackmer, of Los Angeles, has been appointed manager for Northern Ore Co., Edwards, N. Y.

E. Maltby Shipp has returned to New York from an examination of marble properties near Proctor, Vt.

Ralph N. Moore, now with the Morococha Mining Co., Morococha, Peru, will return to Mexico City in December.

R. W. Petre, of Baltimore, is engaged in professional work in the Spottsylvania zinc and lead district of Virginia.

George B. Holderer has recently been appointed superintendent of the Northern Pyrites Co., at Northpines, Ont., Can.

C. T. Griswold, of the Associated Geological Engineers has transferred his activities from Wyoming to Oklahoma.

F. L. Stack, mine captain for the Morococha Mining Co., Morococha, Peru, expects to go to Mexico City early in December.

M. L. Fuller, managing engineer of the engineering division of the Associated Geological Engineers visited the New York office recently.

D. R. Thomas has resigned as superintendent for Moose Mountain, Ltd., to accept the management of the Davidson mine, at South Porcupine, Ont.

R. W. Marston will assume the duties of acting manager for the Northport Smelting and Refining Co., Northport, Wash., in place of Samuel James, who died recently.

Leo M. Banks has been appointed assistant manager of the Braden copper mines in Chile. He left to assume his new position Dec. 2, sailing from New Orleans.

Justice Grugan resigned on Dec. 1 his post as manager for the Northern Ore Co., Edwards, N. Y. He will establish offices as consulting engineer at Room 621, 30 Church St., New York.

G. Komorowski, representing the Girod electric furnace, recently arrived at New York from France. His headquarters are at the offices of C. W. Leavitt & Co., 30 Church St., American agents for the furnace.

Arthur V. Farr, who for the last three years has been advertising manager for the S K F Ball Bearing Co., Hartford, Conn., has accepted the position of sales manager for the Hess Steel Corporation, of Baltimore, Md.

S. S. Sorensen, general manager of the Braden Copper Co., is paying a visit to this country. Pope Yeatman gave a dinner in his honor at Delmonico's, on Nov. 23, at which 16 well-known mining and metallurgical engineers were present.

J. D. Galloway, assistant mineralogist for the province of British Columbia, has returned to Victoria from a five months' trip through the Hazelton district and contiguous areas to the south, which he traversed for the purpose of making a geological reconnaissance.

Michael H. Sullivan, assistant superintendent of the Consolidated Mining and Smelting Co., at Trail, B. C., has resigned to take the position of superintendent of the smeltery and refinery of the Bunker Hill & Sullivan Mining and Concentrating Co., at Kellogg, Idaho.

James Bartlett, Inspector of Mines for the Cobalt and Porcupine districts, in northern Ontario, has been granted a commission in the Tunneling Section of the Canadian Engineers and is at present in training for overseas service at the Engineer Training Depot, St. Johns, Que.

Dr. Nicholas P. Melinkoff, of Petrograd, accompanied by officers of the Northern Pacific and Butte, Anaconda & Pacific railways, paid a visit to the Washoe smelting works at Anaconda on Nov. 23. Doctor Melinkoff is chief engineer of the cabinet of the Czar and is on a tour of inspection in this country.

J. H. Gillis, who was in charge of the drafting work for the new zinc plant at the Great Falls works of the Anaconda company, has left for Toronto, where he will enter the services of the British America Nickel Corporation, joining E. P. Mathewson, formerly manager of the Washoe Reduction Works, at Anaconda.

William Sloan has been appointed Minister of Mines in the newly formed Ministry of British Columbia. He came originally from Wingham, Ont., and went to the Yukon in the early days of the gold rush. He is a practical mining man and for four years represented the British Columbia constituency at Comox-Atlin, in the Canadian Parliament.

Obituary

William Linney, age 55, veteran employee of the Bunker Hill & Sullivan Mining and Concentrating Co., killed himself on Nov. 23, at Kellogg, Idaho, by shooting himself in the head. He had been ill for several months with tuberculosis, and was not expected to recover. He came here 29 years ago, and is survived by his widow and six children, Edward, William, Fred, Roy and Clara, all of Kellogg, and Mrs. Stella Newell of Smith's Ferry.

Joseph N. Webb died at Johannesburg, South Africa, in the week of Oct. 2, 1916, at the age of 75 years. Mr. Webb was born at Wynberg, Cape Province, in 1841, and as an incorporated accountant attained to many responsible positions. He was a Director of the National Bank of the Free State, a Director of the Rose Deep and other Rand mining companies, besides being auditor for many mining companies. In his early days Mr. Webb received the Royal Humane Society's medal for saving life on the East London bar. He was one of the oldest members of the Johannesburg Stock Exchange.

John R. Patience, well-known mining man of the state and one of the first shift bosses in the Highland Boy mine, at Bingham, died on Nov. 23, of pneumonia at his home in Salt Lake City. He was 51 years of age. Mr. Patience came to Utah about 22 years ago from Montana. He was employed for some time by Thomas Weir following the opening of the Highland Boy mine, later moving to Tintic, where he leased at the Ajax and other properties. He was well known in these districts and in Utah mining circles. During the past several years Mr. Patience has been engaged in inspecting samples for mines in this vicinity. Born in England, Mr. Patience came to America when 14 years of age. He is survived by his widow.

Samuel James, 62 years old, manager of the Northport smelting plant, died Saturday, Nov. 25, at Northport, Wash., of apoplexy.

Mr. James went to Denver in 1889 and became superintendent of the Globe smelting works. He remained in this position for two years and then went to Murray, Utah, where he was placed in charge of the Mingo Smeltery. He returned to Colorado in 1901 and for two years was manager of the Arkansas Valley plant at Leadville. From Leadville he went to Salida, where he took charge of the Ohio & Colorado plant. He remained there for four years and went to Matehuala, Mexico. He remained in Mexico until a year ago, when he went to Northport to manage the lead-smelting plant there.

Mr. James was a native of Boston and was graduated from the Massachusetts Institute of Technology in 1876. He was recognized throughout the West as a foremost expert of metallurgy. His adopted daughter is Mrs. J. E. Wardecke, of Denver.

William Cooper Cuntz, manager for the Goldschmidt Thermit Co., died on Nov. 2, 1916, at Auburndale, Mass. Mr. Cuntz was born in Hoboken, N. J., in 1871. His maternal grandfather, after whom he was named, was William Cooper, a well-known naturalist and one of the founders of the New York Academy of Science. Mr. Cuntz was educated at the Hoboken Academy, and at Stevens Institute of Technology, graduating from the latter in 1892, with the degree of Mechanical Engineer. He then became connected with the Pennsylvania Steel Co., of Steelton, Penn., first with the Bridge and Construction Department, which he represented as Resident Engineer in Boston, Mass., and as European Resident Engineer in London, England. In 1910 he was appointed by President Taft a delegate to the International Railway Congress, at Berne, Switzerland. In the same year he severed his connection with the Pennsylvania Steel Co. to become a director and the general manager of the Goldschmidt Thermit Co., of New York.

Frederick James Hamilton Merrill, State Geologist of New York from 1899 to 1904, died from a stroke of paralysis on Nov. 20, 1916, in Los Angeles. Since going to California, in 1904, Mr. Merrill had been engaged in private practice as a mining geologist. For three years he had been field assistant in the California State Mining Bureau.

He was born in New York on Apr. 30, 1861, and was graduated from the Columbia School of Mines in 1885, receiving the degree of Ph.D. five years later. From his graduation until 1889 he was assistant in the Geological Survey of New Jersey. In 1890 he entered the service of New York as assistant director of the State Museum, becoming director four years later and holding the position 10 years.

At the World's Fair at Chicago in 1893 he was director of the state's scientific exhibit, performing the same duty later at Buffalo and St. Louis. He was a Fellow of the American Association for the Advancement of Science, the Geological Society of America and the Academy of Sciences and a member of the American Institute of Mining Engineers, and the Mining and Metallurgical Society of America.

In 1887 he married Winifred Edgerton, who survives him with four children, Louise, Hamilton, Winifred and Edgerton.

Societies

National Association of Stationary Engineers will be entertained on Dec. 12, at Coplay, Penn., with a series of three industrial motion-picture films illustrating the manufacture of iron pipe by the National Tube Co. These pictures were taken under the direction of the National Tube Co., Pittsburgh, Penn., and show all stages of pipe manufacture, from ore mining to finished pipe.

National Association of Brass Manufacturers will hold its 30th annual meeting at the Hotel Astor, New York, on Dec. 13 and 14. The unusual trade conditions now existing tend to make this meeting one of the most interesting and important in the history of the organization. All brass manufacturers, whether members or not, are invited to attend and confer with their fellow manufacturers as to the wise course to pursue in view of the erratic course of the metal market. On the evening of the second day's session there will be a banquet and dinner, and the following have been appointed a committee to make the necessary arrangements: A. S. Hills, chairman, Haydenville, Mass.; C. C. Hale, New Haven, Conn.; C. H. Downs, Springfield, Mass. Further information as to details can be had by addressing William M. Webster, commissioner, 1818 City Hall Square Building, Chicago.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Calorimeter — Continuous Gas Calorimeter. Frank Gottlob Breyer, Palmerton, Penn., assignor to the New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,205,704; Nov. 21, 1916.)

Electric-Arc Furnace. Clas Walther Harry von Eckermann, Ljusne, and Ivar Rennerfelt, Djursholm, Sweden. (U. S. No. 1,206,057; Nov. 28, 1916.)

Furnace-Lining Material and Process for Preparing Same. Charles J. Barr, Birmingham, Ala., assignor to Allen S. Davison Co., Pittsburgh, Penn. (U. S. No. 1,206,771; Nov. 28, 1916.)

Ingot Stripping—Method and Apparatus for Stripping Ingots. Edwin E. Slick, Westmont Borough, Penn. (U. S. No. 1,206,150; Nov. 28, 1916.)

Ingots—Method of Making Ingots. James E. York, New York. (U. S. No. 1,206,188; Nov. 28, 1916.)

Mine Car. Edwin E. Slick, Westmont Borough, Penn. (U. S. No. 1,206,042; Nov. 28, 1916.)

Ore Car. William C. Carr, Buffalo, N. Y. (U. S. No. 1,206,091; Nov. 28, 1916.)

Pump—Displacement Pump. Elmer A. Watts, Springfield, and Irwin L. Dunn, Marietta, Ohio. (U. S. No. 1,206,065; Nov. 28, 1916.)

Sintering—Ignition Furnace for Sintering Machines. Frederick W. Yost, New York, N. Y., and Bethune G. Klugh, Cleveland, Ohio, assignors to American Ore Reclamation Co., New York. (U. S. No. 1,206,397; Nov. 28, 1916.)

Tunneling Machine. Samuel Hoar, Virginia, Minn. (U. S. No. 1,206,437; Nov. 28, 1916.)

Assessments

Company	Delinq.	Sale	Amt.
Atlantic, Ida	Dec. 9	Jan. 9	$0.001
Beaver Copper, Utah	Dec. 11	Dec. 30	0.005
Buffalo, Ida	Nov. 15	Dec. 12	0.005
Carbonate Keystone, Utah	Dec. 14	Jan. 2	0.01
Century Gold, Utah	Dec. 10	Jan. 10	0.01
Challenge, Nev	Nov. 29	Dec. 20	0.05
Christmas, Utah	Nov. 20	Dec. 16	0.005
Con. Virginia, Nev	Dec. 8	Dec 29	0.05
Eagle Mtn., Ida	Dec. 22		0.001
East Hercules Ext., Ida	Jan. 2	Feb. 2	0.0005
Ely-Gibraltar, Nev	Dec. 15	Jan. 10	0.0025
Emerald, Utah	Dec. 15	Jan. 13	0.001
Eureka, Ida	Dec. 9	Jan. 9	0.001
Exchequer, Nev	Dec. 5	Dec. 27	0.03
Federal Ely, Nev	Dec. 2	Dec. 20	0.005
Four Timbers, Ida	Dec. 2	Jan. 2	0.002
Hector, Ida	Dec. 22	Jan. 16	0.005
Idaho-Nevada, Idaho	Nov. 15	Dec. 16	0.002
Idora, Ida	Nov. 24	Dec. 23	0.005
Imlay, Nev	Dec. 19	Jan. 9	0.01
Iron King, Ida	Dec. 9	Jan. 9	0.001
Lion Gold, Utah	Nov. 13	Dec. 5	0.0025
Mayflower, Ida	Dec. 23	Jan. 25	0.005
Mexican G. & S., Nev	Nov. 25	Dec. 18	0.10
National Lead, Ida	Nov. 25	Dec. 26	0.001
Nevada Zinc, Nev	Nov. 26	Dec. 16	0.01
New Hope, Ida	Oct. 11	Dec. 11	0.002
North Franklin, Ida	Dec. 30	Jan. 22	0.005
O.K. Extension, Utah	Dec. 21	Jan. 10	0.0025
Paloma, Utah	Dec. 12	Dec. 28	0.015
Pittsburgh Cons., Utah	Nov. 17	Dec. 8	0.0175
Rarus M. & S., Utah	Dec. 16	Jan. 4	0.00075
Reindeer Queen, Ida	Dec. 16	Jan. 22	0.005
Silver Moon, Ida	Nov. 25	Dec. 23	0.005
Silver Pick, Nev	Dec. 2	Jan. 8	0.02
Tarbox, Mont	Dec. 22	Jan. 13	0.005
Tiberius, Ida	Dec. 21	Jan. 12	0.00075
Wallace M., M. & R., Ida	Dec. 8	Jan. 8	0.0025

The publication of this table will be discontinued after Dec. 30, 1916.

Editorial Correspondence

SAN FRANCISCO—Nov. 29

Metal Production in California in 1915, according to Bulletin 71 issued by the State Mining Bureau, amounted to $96,663,369. A total of 49 metallic and nonmetallic minerals was contributed by 56 of the 58 counties in the state. There was a total increase over 1914 of $3,348,596; the largest gains were in the copper and gold output. Quicksilver and zinc increased in a greater ratio than usual and there were increases also in borax, lead, platinum, potash and natural gas. Petroleum decreased approximately 12,000,000 bbl. and $3,983,272 in value. The bulletin attributes the decrease in petroleum to overproduction in previous years, the closing of the South American trade due to the war and threatened litigation by the Federal Government.

Hull of Yuba No. 16 Dredge was launched at Hammonton on Nov. 26. This is of same size and design as Yuba No. 15 except that it is equipped with two tailing stackers and is a little heavier in total weight than Yuba 15, which is approximately 2,300 tons. The first steel was laid in construction on Sept. 20, making a total of 37 elapsed days. The purpose of two stackers instead of one is to place the tailing on either side of the channel of Yuba River, in conformity to agreement with the Government for the reclamation of this part of the river channel. Rainy, cold weather prevented as large a crowd at the launching as was present at the launching of No. 15. There were, however, about 200 people; among them were W. P. Hammon, president, and Newton Cleaveland, manager of the Yuba Construction Co. and of various operating companies, and J. H. Miles, superintendent of the Alaska Mines Corporation. The dredge went into the water smoothly and without a hitch in the launching. It will be equipped with 16-cu.ft. buckets designed to dig 80 ft. below water line and is one of the largest gold dredges in the world. The dredge will be operated by the Yuba Consolidated Gold Fields, George Carr, manager. It was designed and built by the Yuba Construction Co. and constructed under the superintendence of Paul E. Morse.

BUTTE—Nov. 30

Butte & Superior Wins another point in the flotation litigation by the decision of Judge George M. Bourquin, of the Federal District Court on Nov. 28. This denied the petition of Minerals Separation, Ltd., asking for an injunction to restrain the Butte & Superior company from declaring dividends and distributing its profits to the stockholders in this manner. The court also discharged the Butte & Superior company from the order issued Nov. 13, 1913, requiring it to post a bond in the sum of $75,000 to secure a possible judgment for infringement of patent on the flotation process it uses, and requiring monthly reports of the results of the process at its mill. The decision is a victory for the Butte & Superior company so far as this phase of the controversy is concerned and permits the company to proceed with its plans for the enlargement of the mill. Attorneys for Minerals Separation have filed the necessary notices of appeal but it is probable that the decision of the United States Supreme Court, which is expected daily, will dispose of all the points involved in this and similar suits against other companies over the patent question.

Wages Again Advanced by Butte mining companies added to the Thanksgiving feeling in this district. The companies on Nov. 29 posted notices at their properties to the effect that beginning Dec. 1, miners will receive $4.75 per day as long as the average monthly selling price of copper remains 27½c. per lb. or more. Employees at the Washoe and Great Falls smelteries of the Anaconda company will also receive the 25c. increase. All office employees of the Anaconda company receiving $300 a month or less will have their salaries increased 5%. This is the third time this year that the mining companies in Butte have voluntarily raised the wages of their employees. It is indeed a justified cause for thanksgiving in Butte that the relations between capital and labor at Montana's great mining center are so cordial and sympathetic and that the good will borne by the employers toward their employees takes a form so tangible. The mining industry is thriving as it never did before and it is just that the workers should have a share in the increased profits from the metals they are helping to produce. It is not only Butte, however, that is benefited by this prosperity. Silver Bow County and the state as a whole receive a share of the wealth created by the prevailing conditions. On Nov. 29, the Anaconda company paid its taxes in various counties of the state, the checks sent out in receipt for tax claims against the company amounting to $984,551. More than half of this went to Silver Bow County and the City of Butte. Another big check was that of the Butte & Superior company for approximately $325,000. Altogether there is good ground for rejoicing and for thanksgiving in Butte and in Montana as far as material things are concerned. Neither have the higher aims of humanity been lost sight of. The welfare of Butte's young men has been in the minds of thoughtful citizens for some time. The subject took concrete form in the raising of $200,000 within a period of only 10 days for the building in Butte of a Y. M. C. A. building, that will be needed all the more when saloons and other nefarious resorts will have passed out of existence in conformance with the overwhelming vote for prohibition cast at the last election.

Third Section of Electrolytic Zinc Plant, at Great Falls, has been placed in operation with the result of an enlarged market for Butte's zinc ores. The shipments of zinc ores from the Emma, Poulin, Lexington, Alice, Pilot Butte and other Butte mines of the company has been averaging close to 1,050 tons of ore per day for the last month. This will be increased to a daily average of 1,300 tons at once. In addition a contract has been made with the North Butte Mining Co., by which 200 tons of zinc ores daily will be taken from that company or a total of 1,500 tons of zinc ores from the Butte mines. The zinc ores from the North Butte come mainly from the 2,000- and 2,200-ft. levels, where an 11-ft. vein was opened. Arrangements have also been made by the Anaconda company to maintain through the winter the shipments of ore from the Douglas mine in the Coeur d'Alene district of Idaho. Messrs. Shipley and Fox, of Wallace, Idaho, have the transportation contract and it calls for the handling of from 100 to 200 tons of zinc ores per day. These have to be hauled a distance of 9 mi. from the mine to the nearest railroad point; teams, auto trucks and sleds will be utilized. In order to reduce the amount needed to be hauled, the Anaconda company has completed arrangements to install a mill at the mine; also compressor plant, hoist and pumps.

Southern and Western Section of Butte district will see a large amount of exploration work within a short period; this is clearly indicated by the fact that some of Butte's prominent companies, among them the Anaconda, have entered the field with substantial evidence of continuous operation. In past years these sections have been exploited in a more or less haphazard way for the silver ores they contained. When the price of silver fell to its low level and zinc was encountered, which was worthless then, operations were discontinued and the mines were allowed to fill with water, to cave and to become practically abandoned. Since Butte has entered the lists as one of the largest zinc producers in the country, individuals and companies have bestirred themselves not only to prove the existence of almost unlimited amounts of zinc ores within the boundaries of the Butte camp, but have already developed many of the Butte zinc mines to the point of production. Anaconda not only participated in the exploration of the zinc resources in Butte and other localities, but its technical staff, headed by Frederick Laist, made possible the economical treatment of these Western zinc ores in the region in which they occurred. Having placed the Nettie mine, 2 mi. west of the Anaconda Hill and the Emma mine in the southern section of Butte in a condition for continuous operation, the Anaconda company has begun the sinking of a 1000-ft. shaft on the Bonanza claim, one of a recently acquired group of claims adjoining Senator Clark's Trevona and Ancient claims on the west, all situated in the southern district of the Butte camp. This step by the Anaconda company has brought into prominence a large number of mining claims in that locality which have been neglected since the days of the silver boom and which are now spoken of as possibilities to be turned into prominent zinc producers. A little farther east of the Bonanza and the Clark properties is the Ophir group of claims, owned by the Butte-Detroit company, which has planned extensive development work on these claims. The Davis-Daly company may soon start operations at some of its western properties near the Nettie mine of the Anaconda company, having made satisfactory arrangements with the Butte-Detroit company for milling facilities in the latter company's plant at the Ophir mine. Altogether, the development of Butte's zinc resources promises to be a rapid one and will probably heighten even Butte's present fame as a mining camp.

DENVER—Nov. 29

Alma District was given as much attention by prospective investors and their engineers during the last summer as the short open season for such investigation would permit. Winter closed in before many decisive results were attained. However, under management of Louis L. Davis, of Denver, the old Magnolia mine on the south slope of North Star Mountain, near the historic camp of Montgomery, has been reopened in conjunction with the making of repairs and improvements in the old Eddy mill, while a new 3,700-ft. aërial tramway is under construction down the mountainside to connect the two properties. The orebody is along a fissure in Cambrian quartzite, the ore being deposited both in the vein and as a replacement laterally in the country walls. The main value is gold and the gangue is silica. Pockets carrying small amounts of copper are occasionally found. This mine has been worked at times for many years but the handicaps have always been so great that only the highest grade ore could be profitably mined, packed down the mountain on burros, hauled in wagons 7 mi. to Alma, shipped by rail to Denver and there smelted. The Magnolia is a close neighbor to the Atlantic and Pacific mines that have had similar history although credited with large productions. The mill will be put into operation as soon as the tramway is completed and its flowsheet will include crushing, stamping, amalgamating and cyanide leaching. The ore that will be mined for a considerable time is oxidized.

Leadville Unit—the Leadville branch of the U. S. Smelting, Refining and Mining Exploration Co.—has abandoned its intention of leasing out portions of its old workings. Recent exploration of these old mines has proved them to be well worth operation on company account. Manager H. S. Lee is making plans to sink the Jamie Lee shaft on Fryer Hill to new depth, this and its neighboring workings being now completely drained by the pumping operations that have been maintained for some months in the Harvard shaft. The Harvard, Tip Top and Jamie Lee mines have newly laid compressed-air lines to convey air from the surface plant at the Harvard. Steady shipments of zinc carbonate are now maintained from the Tip Top and similar shipments will soon commence from the Jamie Lee. Thus one of Leadville's 1916 drainage projects has attained fruition. Some delay is being experienced in the other drainage projects due to unusual and unforeseen flows of water. Downtown Mines continues heavy pumping at the Penrose shaft, meanwhile conducting exploration in some of the upper levels. The Layne & Bowler electric sinker at the Greenback shaft is merely holding its own against the flow, but it is expected that the adverse condition will soon change. This shaft was drained readily during former operations and the present handicap cannot be accounted for.

SALT LAKE CITY—Nov. 29

First Steel Rails Ever Made in Utah were shipped from the plant of the Utah Iron and Steel Co. during the week ended Nov. 26. This works at Midvale is making improvements and additions at its mills.

Monument to Tony Jacobson, the former mining operator in the Cottonwood camp, of Alta, was unveiled in Salt Lake City on Nov. 26, when many mining men of Alta gathered at the City cemetery to express their respect for the former operator. George H. Watson was chairman of the committee, which had the gift in charge. The shaft of the memorial is made of Cottonwood granite and the base is of Swedish marble.

Further Wage Increase has been made by the Utah Copper Co.—the fourth since August, 1915—to be effective Dec. 1 to employees of the company's mines at Bingham and of the Magna and Arthur mills at Garfield. The increase will be 25c. a day for labor receiving more than $3.05 and 20c. a day for labor receiving less than this sum. All common labor working 9 hr. will be increased 20c., and all labor working 8 hr., 15c. Machine men will receive $4.25 and muckers $3.25 under the new wage scale. The increase is to remain effective as long as copper sells for 27½c. per lb. at New York. It affects about 4,000 men, there being 1,600 men employed at the mines and the remainder at the mills and on construction work. The dates on which successive wage increases were made are: Aug. 1, 1915, Jan. 1, 1916, May 1 and Dec. 1. Other Bingham companies will probably increase wages also.

Purchase of Ohio Copper Property by the North American Liquidation Co. of New York for stockholders has been approved by Judge Hand, of the Federal district court, who has issued an order directing the trustees in bankruptcy to execute the deeds. The price bid was $1,350,000. Under the plan of reorganization the stockholders will deposit their holdings with the new company and pay an assessment of $1 a share. Myers & Goldsmith, attorneys for the North American Liquidation Co. and the stockholders' protective committee, of which Hubert E. Rogers is chairman and the New York Trust Co. is trustee, have stated that the title will be closed at an early day next week, and further that many stockholders have

already accepted the plan and made deposits of stock in a large amount. It will be recalled that the bondholders bid in the property at foreclosure sale in August, 1916, for $750,000. The property has been operated under lease by the General Exploration Co., of which Alfred Frank was manager.

WALLACE, IDAHO—Nov. 26

Mining Interests of the Northwest are outspoken in condemnation of the selection of Seattle as the site for the new mining-experiment station for the Northwest. Seattle is far removed from mining activity, present and prospective, in the territory to be served by the station. It is true that it is the great supply point for the mining fields of Alaska, but the Government has already provided for experimental work in Alaska by authorizing the establishment of a station at Fairbanks. There is considerable coal mining in the vicinity of Seattle, but hardly sufficient to justify the establishment of an experiment station, and besides it is understood that the experiment stations in the West are primarily intended for the benefit of metal mines. It is openly charged here that political considerations influenced the selection. After the field had been carefully examined, it was announced that Secretary Lane would withhold announcement of the station site until after the election. The selection of Seattle immediately followed, the election returns showing that the State of Washington had "delivered the goods." Having in view solely the advantages to be gained by the mining industry, Coeur d'Alene operators feel that the station should have been placed either in Idaho or Montana, the two great mining states of the Northwest.

ISHPEMING, MICH.—Dec. 2

Sales of Iron Ore for 1917 Delivery were made this week at an advance of $1.50 a ton over the 1916 prices. This is going to give the mining industry in the Lake Superior district a big stimulus. Most of the underground mines are already operating to capacity, but the increased prices will mean the development of many new properties. The prices, which range from $5.05 for Mesabi non-bessemer to $5.95 for Old Range bessemer, are the highest recorded in over 25 years. The prices for Mesabi ores are the highest in the history of that range, which was opened in the early '90s. Although the mining companies will have to pay an additional 50c. a ton to get their ore down the Lakes next season and about 25c. a ton additional costs at the mine, it will leave a net of about 75c. a ton more than they have been receiving. Wages are to be increased 10% by all of the operators on the first of the year. Most of the sales thus far reported have been on bessemer grades, the furnaces evidently preferring the low-phosphorus ores to the high-phosphorus at this time. The other ores will move later, as every ton that the district can produce in 1917 will be needed. It is estimated that close to 75,000,000 tons will go down the Lakes next year, which will be more than 10,000,000 tons in excess of the 1916 shipments. There is some talk that there will be another strike on the Minnesota ranges next spring, and it is believed that the rumors are founded on facts as the I. W. W. agitators are keeping up their work in that field. A vote was taken in the Biwabik district a few days ago and the men voted to go out on strike on Apr. 1, 1917. Some favored walking out on Jan. 1, but the majority decided to wait until navigation opens in the spring. Every effort will be made by the I. W. W. to get some of their men chosen to offices at the village elections to be held in Minnesota in March, but it is believed that a majority of the other workmen will be opposed to them. The operators are getting out all of the ore they possibly can from their underground mines, in order to have plenty in stock by spring.

GOUVERNEUR, N. Y.—Dec. 2

St. Lawrence County, N. Y., has experienced a healthy development of its mining industry, this year. Recently, the sale of the Caledonia hematite mines, a part of the Joseph Wharton estate, is reported to have been made to the American Vanadium Co. They were last worked about six or seven years ago and have a good record for production and grade of ore. The Benson magnetite mines are again in operation; the mill has been converted into a wet plant, using the Gröndal process and the results of its operation will be awaited with considerable interest in view of the favor hitherto shown for the dry process.

JOPLIN—Dec. 3

The Greatest Find in Recent Weeks—excluding strikes in the Oklahoma field—is that of the Little Martha Mining Co. on the old Baltimore tract at Chitwood, Mo. Working through a shaft of the American Zinc, Lead and Smelting Co.'s B. & M. mine, the Little Martha has opened up a big body of ore that is giving a better return than 10%, and the face is so large and regular that 9 men in the ground are keeping the 250-ton mill busy.

Further Curtailment of Electric Power, as the result of another accident at the local electric company's Riverton plant on Nov. 30, tended to keep down production in this district during the week. Following the accident the company notified the mining operators that electric current must not be used except for pumping. This meant a complete shutdown for many large mining plants, including the A. W. C. and Gibson mines at Joplin, the Picher properties at Picher, Okla., and several properties at Webb City. It is estimated that the shutdown affected at least 20% of the district's production. The company hopes to get the damage partly repaired by the middle of the coming week, and permit mills to be operated at night, which is the best service afforded for some weeks. Meantime, the electric company is spending at least $300,000 in extensive improvements that should guarantee an ample supply of current in future. Many operators with electric equipment would change to coal or gas at this time, but they cannot be guaranteed a supply of either. Coal is so scarce that dealers want no new customers, and domestic consumers of gas are agitating to prohibit its use by mining companies during the winter months.

WASHINGTON, D. C.—Dec. 2

Geological Report on Juneau Gold Belt is to be made by the U. S. Geological Survey to meet the demand of increasing development in that district. A detailed report of its geology is being prepared by A. C. Spencer and H. M. Eakin.

Placer Mining Problems are to be given chief attention at the new Fairbanks mining experiment station. The details of the study which is to be made have not been decided upon but will be worked out within the next few weeks. This matter is to be threshed out in Washington between Van. H. Manning, director of the Bureau of Mines, F. G. Cottrell, chief metallurgist, and John A. Davis, who will have charge of the new Alaska station.

Average Age of Employees of the Geological Survey is 37 years, refuting the charges often made that the Government service is dominated by men and women past the prime of life. A service tabulation applying to the Geological Survey shows this bureau to have about 900 employees of the average age above stated. Among the 188 geologists in the service of the Bureau, the average age is 39.5 years. It is said frequently that Government employees are "life-termers." This also is belied by the Geological Survey figures. The average term of service in the Survey since its stablishment in 1879 has been 10 years; among the geologists the average service has been 11.5 years. Five members of the Survey staff have been connected with it ever since its organization.

TORONTO—Dec. 4

Smeltery Smoke is now bothering beekeepers in Ontario. It is claimed by landowners in the neighborhood of Thorold, Ont., that the gases from the smeltery of the Coniagas Reduction Co. in that town are destructive to the honey-producing industry. Actions have been brought in the Supreme Court by nine beekeepers in Thorold Township, who have filed claims against the company varying in amount from $240 to $10,000, on the ground that their colonies of bees were destroyed by the gases.

Better Forest-Fire Protection was urged on Nov. 28 before Hon. G. Howard Ferguson, Ontario Minister of Lands, Forests and Mines, by a large deputation representing the Canadian Forestry Association and the lumbering, mining and commercial interests. In reply, the minister stated that the Government had had the matter under consideration and had decided that the whole system must be reorganized to meet present conditions. A separate branch of the department will be organized to deal entirely with the question of forestry and fire protection. Edmund J. Zavitz has since been appointed chief of the new branch. Legislation will be passed at the coming session of the legislature giving him wide powers of control, an important feature of which will probably be the adoption of the permit system under which settlers will be prevented from starting fires for clearing except as authorized by the fire rangers. It is also understood that town councils may be given extended fire-protection authority with jurisdiction for a certain distance outside the municipality.

The Mining News

ALASKA

JOSEVIG-KENNECOTT COPPER CO. (Kennecott)—New copper flotation; property comprises 22 claims about 7 mi. from Kennecott; reports 13½-ft. vein in one of its tunnels; also chalcocite orebody on Dagne-Marie claim. D. K. McDonald, Spokane, Wash., president.

ALASKA-STANDARD COPPER MINING CO. (Landlock)—Another new copper flotation; owns 5 claims adjoining Standard mine on which company has option at price of $500,000. Several tunnels and cableways to wharf at Landlock Bay. M. L. Hewett, of Montana, and W. J. Stoneham, of New York, interested.

ARIZONA

Graham County

GERONIMO MINING (Geronimo)—Copper sulphide reported struck by churn drill No. 1 at 85 ft.

SOUTHLAND COPPER (Pima)—New organization of C. C. Bialock, A. J. Welty, and V. C. Harland; has 27 claims, situated 25 mi. southwest from Pima.

Gila County

IRON CAP COPPER (Copper Hill)—Initial dividend of 2% declared on common stock, also regular semi-annual dividend of 3½% on preferred stock, payable Jan. 1. Crosscut from Iron Cap shaft passed through 36-ft. vein, 2 ft. on the hanging wall containing copper. Another crosscut is to be run at a depth of 800 ft.

Mohave County

ARIZONA CROSS-BAR MINING (Oatman)—Sinking 2 shafts; machinery being installed.

OLD WHITE HILL (Kingman)—R. T. Boot, owner, plans to resume operations.

Pinal County

QUEEN CREEK COPPER (Superior)—Contract let to explore with diamond drills the Windsor and Neary grounds, adjoining Lake Superior & Arizona on south.

RAY CONSOLIDATED (Ray)—Produced in October 7,590,038 lb. of copper, an increase of 1,339,101 lb. over September and the highest output ever made at this property.

RAY HERCULES (Ray)—Contracts let for new concentrator which, it is now reported, will start with capacity of 2,000 tons instead of 1,000 tons, daily, as originally planned.

Santa Cruz County

WANDERING JEW (Alta)—New concentrator, being installed, may be enlarged.

DUQUESNE MINING AND REDUCTION (Duquesne)—Shipped 25 carloads of ore and concentrates in October.

Yavapai County

MIDNIGHT TEST (Prescott)—Old workings reopened to below 300-ft. level; silver ore blocked out; air compressor and four drills ordered.

HOMESTEAD CONSOLIDATED MINES CO. (Walker)—High-grade milling ore, gold, silver, lead and copper, struck on 100-ft. level.

GOLDEN BELT (Turkey)—Lon D. Hall and W. W. Elliott plan construction of mill and cyanide plant; 80,000 tons ore reported blocked out.

CALUMET & ARIZONA (Warren)—This company, which was last week reported to have optioned the News group of 6 claims, is now said to hold options on the Sutter-Larson, Monster, Larrimore and Howe groups, making an area of nearly 600 acres extending from the Green Monster on south to the United Verde Extension on north.

JEROME COPPERFIELDS, INC. (Jerome)—Another Jerome flotation. Property 3 mi. north of United Verde. James Westervelt, trustee, Globe, Ariz.

CALUMET & JEROME (Jerome)—Benjamin Gillies, mining engineer, who recently examined this and other properties in Jerome district for Lewisohn Bros., of 11 Broadway, New York, has been appointed consulting engineer; has recommended construction of tunnel from the Duluth to the Franklin claim; also the sinking of a 1,000-ft. shaft.

Yuma County

EMPIRE-ARIZONA COPPER CO. (Parker)—Shipping 500 tons monthly to American Smelting plant at Hayden, averaging 5½% copper and about $4 in gold. Property comprises 30 claims, 10 mi. north of Parker, developed by 4,000 ft. of underground work including three shafts and two tunnels. Has been shipping siliceous ore from Carnation shaft, but basic ore from Eagles Nest shaft will soon be shipped. Head office in Title Insurance Bldg., Los Angeles; C. E. Finney, vice-president.

CALIFORNIA

Amador County

ORIGINAL AMADOR (Amador City)—On the 850 level, ore of better grade than on the upper levels. Mill capacity increased from 150 tons to 250 tons per 24 hr.

CENTRAL EUREKA (Sutter Creek)—Recent labor strike cost company $1,090, paid to watchmen for guarding property during October. Operation resumed Nov. 6; regular work was suspended Sept. 19. Some repairs made during

strike; tailing dam strengthened and increased in capacity. Deepening of shaft recently started; two new levels will be made.

LIGNITE FUEL CO. (Ione)—Lignite deposits, near Carbondale, being prospected by drilling and shaft sinking, to develop material for the briquetting plant.

LINCOLN GOLD MINING CO. (Sutter Creek)—New incorporation capitalized at $250,000 in ten shares, organized by F. D. Buck, George W. Dillman, and M. L. Horten. Will reopen old Lincoln-Consolidated mine, adjoining the Wildman-Mahoney.

CONSOLIDATED AMADOR (Sutter Creek)—Water lowered to 950-ft. point, known as the 1,000 station. Unwatering has averaged 10 ft. per day, though frequently 20 ft. per day has been made. Timbers 28 in. in diameter are found to be intact and apparently as sound as when installed, 40 years ago. Another pump and large tank are to be placed at the 1,000 station for handling water from the lower levels; an 18-in. concrete floor is being laid for this purpose. The headframe will stand on concrete piers and will be built of steel and heavy timber. Expected that mine will be unwatered by the end of year.

Eldorado County

MT. PLEASANT (Placerville)—Reopening mine in early spring contemplated. Fuel is being hauled in. Control recently reorganized by F. C. Van Schaick, of San Francisco. Property developed by 1,000-ft. shaft and equipped with 10-stamp mill.

HOLLY QUARTZ MINING CO. (Placerville)—Permit by commissioner of corporations to issue 17,000 shares to C. A. Dysle, 6,250 to Louis Scholler, 1,750 to George E. Corey in exchange for Lemon mining claim, and to sell 5,000 shares at $1 per share. Property has been worked by surface cuts and shallow shafts and tunnel. Expect to deepen shaft to a point below tunnel level.

Nevada County

ALLISON RANCH (Grass Valley)—Expect to have mine unwatered by end December. New hoist being installed; 50 men employed.

OCEAN STAR (Washington)—Reconstruction of 10-stamp mill in progress. Mill recently installed destroyed by fire of alleged incendiary origin.

Plumas County

INTERNATIONAL SMELTING CO. (Portola)—Reported that company will acquire another copper property in connection with the Walker mine. Ralph Nichols, consulting engineer, making examination.

CRESCENT (Crescent Mills)—Old producing mine, in Indian Valley, will be reopened by Philadelphia Exploration Co. Reported that the Great Western Power Co. will extend lines to Crescent Mills and that this and other mines will be electrically operated.

San Bernardino County

AMERICAN TRONA (Trona)—Cable read at meeting in London Nov. 21 stated: "We should produce daily at least 70 tons salts 50% KCl or better (an increase of 20 tons over previous estimates). . . . Up to now about 400 tons have been forwarded."

UNITED TUNGSTEN MINES CO. (Victorville)—Reported that high-grade scheelite has been disclosed at contact of granite and limestone. A 50-ton mill planned. William K. Weaver, Warren Gillelen, J. Wells Smith, H. A. Cole, Frank F. Peard and E. M. Coplen, of New York, are interested. D. G. Kidder is manager.

Siskiyou County

McBRIDE RANCH (Callahan)—About 100 tons of chrome ore have been extracted and shipped to Niagara Falls.

MANGANESE CO. (Callahan)—On Grouse Creek has extracted about 100 tons of chrome ore, but no shipments yet made.

DEXTER DREDGING CO. (Callahan)—Development in progress on Mule and Grouse Creeks of quartz properties, owned by Chapman brothers and Ronning.

Sierra County

BEAR CREEK (Alleghany)—Rich quartz struck; mill repaired and crushing begun. Nixon & Smith, owners.

OSCEOLA (Alleghany)—Formerly large producer; bonded to R. G. Gillespie, of Pittsburgh, Penn. Electric power and milling plant being installed.

TWENTY ONE (Alleghany)—Additional 10 stamps being installed, water power being increased, and other preparations under way for largely increased output.

MOUNTAIN MINE (Sierra City)—Early-day producer bonded to C. J. Berry, former Alaskan operator, to be developed at depth. A. E. Smith, of San Diego, in charge.

Trinity County

VALDOR DREDGING (Junction City)—Began operation of 7-cu.ft. dredge on Nov. 18; electrically operated.

Tuolumne County

CALIFORNIA GOLD MINING CO. (Tuolumne)—Option taken on Chaparral and adjoining properties. Installation of compressor and machine drills contemplated.

GARFIELD (Sonora)—New shaft started; will be sunk to 200 ft.; drifting and crosscutting also in progress.

COLORADO

Boulder County

DOSS (Wallstreet)—Recent development has opened considerable ore, assaying from $10 to $20 in gold. Machine drills will be installed.

NIL DESPERANDUM (Boulder)—Small force employed on development. Company contemplates installation of machine drills and compressor.

Clear Creek County

ARGO (Idaho Springs)—This Ute Creek property leased by Loomis and Gray, who are cleaning out and retimbering underground workings.

MURRAY MINING CO. (Lawson)—Installation of electric hoist under consideration. Connection made with the Princess tunnel through which property will now be developed.

SCEPTER MINES AND MILLS CO. (Georgetown)—New company, incorporated by A. T. Monson, J. P. Hershey and G. K. Thomas, to develop properties of American Sisters Mining Co. Contract let to sink shaft an additional 200 ft.

ROY LEASING CO. (Idaho Springs)—Operating the Edgar property through Big Five tunnel. Drift being advanced on vein east of tunnel. About 800 tons of ore per month produced from development.

Lake County

CORTELLINI LEASES, on the Ibex and Garbutt mines (adjoining properties) on Breece Hill, Leadville, are producing about 450 tons per day of low-grade gold ore, with occasional lots of rich material; shipments are about equally divided between the two leases. The C. & G. lease in the Ibex or Little Jonny mine, is extracting ore from a large shoot that has thus far defied limitations by development. An interesting development is the discovery of strong veins in the Ibex property carrying important amounts of copper, steady shipments of 8% ore being made, while regular shipments of high-grade zinc-carbonate also emanate from this property.

DERRY RANCH GOLD DREDGING (Leadville)—This dredge has been handling about 70,000 cu.yd. per month and has paid 70% in dividends, this year. Robert F. Lafferty, general manager.

San Miguel County

SILVER BELL (Ophir)—Crosscutting south from main level to prospect the territory owned south of the Silver Bell workings.

PERINO & CO. (Telluride)—Developing the Carruthers property under lease. New mill and tramway recently completed now running, both operated by electric power. Will continue work throughout winter.

Teller County

AILEEN (Victor)—This property on southwest slope of Raven Hill being developed by W. H. Roberts, of Victor. Payable ore opened.

DANTE (Victor)—Development resumed by Consolidated Mines and Reduction Co. Small force underground, and surface plant placed in working order.

ISABELLA MINES CO. (Cripple Creek)—Development on Buena Vista vein on 15th level of Lee shaft opened some 6-oz. gold ore. Clark G. Mitchell, superintendent.

GOLD DOLLAR CONSOLIDATED (Cripple Creek)—Being developed by Union Leasing Co., C. G. Jackson, superintendent. Shoot of $30 gold ore opened on Gold Dollar vein.

UNITED GOLD MINES CO. (Cripple Creek)—A body of 2-oz. gold ore opened in the Silver Tip property by Hemby & Anderson, lessees, operating through the Wild Horse shaft.

SHOO FLY (Cripple Creek)—Two-ounce gold ore developed by Alexander Hickman & Co., lessees, on first level of Hickman shaft, about 110 ft. below surface. Developing also on second level.

IRONCLAD (Cripple Creek)—New company organized to take over Rex mill on Ironclad Hill. Necessary repairs and alterations made and operations will be resumed early in December.

CRESSON CONSOLIDATED (Cripple Creek)—Newly elected directors and officers are: A. E. Carlton, president; Claud Boettcher, vice-president; E. P. Shove, treasurer; Adolph F. Zang, secretary; and Irving Snyder, T. B. Burbridge, Spencer Penrose, Charles M. MacNeill, and Leslie G. Carlton. Extra dividend of 15c. a share in addition to regular monthly dividend of 10c. a share, payable Dec. 10.

IDAHO

Shoshone County

GUELPH (Wallace)—Hoist and compressor delivered at mine. The 100-ft. shaft will be deepened to cut the vein. Electric power.

GOLD HUNTER (Mullan)—Planning changes in concentrator to provide separate treatment for the ordinary lead ore and that running high in silver.

BUNKER HILL & SULLIVAN (Kellogg)—About 250 men employed on construction of new lead smeltery. Stack being erected; also superstructure of furnace and refinery buildings.

MARSH (Burke)—New pump ordered and unwatering mine will begin soon. Probably require 60 days or more. Shaft down 900 ft., with numerous drifts and crosscuts. At 400 level, crosscut will be run to explore O'Neil ground, leased from Federal company.

BLACK BEAR CONSOLIDATED (Black Bear)—Resumption fund of $50,000 being raised. Western Union mill, near Wallace, leased and will be remodeled; also plans to spend about $20,000 in new mine equipment.

HYPOTHEEK (Kingston)—Recent report gives details of ore shipments from June 15, when new mill began operation, to Oct. 31. Five cars of crude ore were shipped and 21 cars of concentrates; net smelter returns, $44,004; operating expenses, $28,367; profit, about $15,000.

MICHIGAN

Copper

MASS (Mass)—Increased tonnage to 1,000 tons per day, having obtained more men.

INDIANA (Rockland)—Shaft now down 100 ft. on the Butler lode. Crosscut will be driven to other lodes.

SUPERIOR (Houghton)—Some good rock recently encountered at the south on the 21st level; valuable enough to warrant further shaft sinking.

ISLE ROYALE (Houghton)—Has raised daily tonnage to about 3,100 tons. New wooden rockhouse for No. 5 will be completed in February. Much development work is being carried on.

MICHIGAN (Rockland)—Three "cuts" (approximately 15 ft.) have been made on the Evergreen lode with success; mass copper encountered, also good amount of stamp rock. The Ogimah lode drift averaging about same as before. From sixth to the fifth level, the raise on the fissure lying above the Butler lode has run into good ore. Diamond drilling in west drift continues.

FRANKLIN (Houghton)—New methods adopted to increase tonnage. First being put in commission on 28th level, where rope-haulage system, operated by compressed-air engine, and modified "caving" system of mining, has been put into service. This eliminates expensive timbering, decreases cost of tramming and cost of mining as a whole. Same system will soon be adopted at the 30th and 31st levels. When completed, it is expected that the tonnage will be increased from about 950 tons to 1,300 or 1,400 tons per day.

Iron

COLBY (Bessemer)—New shaft is to be sunk. Equipment ordered and work will be started this month.

AMASA-PORTER (Amasa)—Orders received to work mine to capacity. Some new machinery will be added.

KLOMAN (Republic)—To be reopened. Shaft is 180 ft. deep. Water has been removed. Hard ore mine; vein only about 7 ft. wide. Idle over 20 yr. Chicago men have taken the lease.

DOBER (Iron River)—Bailing water from mine. Workings permitted to fill with water to fifth level last spring to extinguish burning pyrite. Two bailers working in incline shaft and one in the vertical.

MACKINAW-GARDNER (Gwinn)—Work to be resumed at these shafts in January. They are 1,000 ft. apart; were sunk several hundred feet a few years ago; no drifting ever done. Both have good-sized orebodies. Mine buildings erected.

CLEVELAND-CLIFFS IRON CO. (Ishpeming)—A police force, similar to the one maintained by the Oliver Iron Mining Co. is to be organized. There will be a uniformed officer at every one of the company's properties both night and day. Most of the night watchmen now employed will be made officers.

MISSOURI

Joplin District

DIXIE (Prosperity)—Symmes Mining Co., of Joplin, has restarted mill, and will mine recently discovered orebody northeast of plant.

NORFOLK ZINC CORPORATION (Joplin)—New flotation, 500,000 shares, to erect 300-ton mill on 40-acre tract west of Airedale mine. J. M. Short, president.

FIGHTING WOLF (Joplin)—Contemplate another mill on lease at Zincite. Now making three cars of concentrates every two weeks in 150-ton mill. Operations at 65 and 80 ft.

INDEPENDENCE (Joplin)—Has opened second shaft on lease north of Bell Center. Problem of water shortage solved by pumping from Lucky George mine, 500 ft. southeast.

U. S. PAYMASTER (Joplin)—Constructing 150-ton new mill on Llewellyn land, north of Bell Center. Two shafts in ore. Soft ground to be worked at two levels, 120 and 157 ft. Junius Case, Ruddells, Ark., principal owner.

LATOKA (Joplin)—New mill at Oakland, in Webb City camp, started by Short Land and Mining Co on 10-acre lease near Hornbrook property. Rich ore in disseminated formation at 200 ft. Mill capacity 150 tons per shift.

STATE LINE (Miami, Okla.)—Getting good results in drilling campaign on 36-acre tract on Kansas-Oklahoma line north of Picher, Okla. Rich ore at 230 ft.; 15-ft. face. Shafts will be started soon. J. A. West, of Commerce, and associates interested in property.

U. S. SMELTING (Miami, Okla.)—Completed rebuilding of old Ravenswood mill, formerly at Reeds, Mo., on 60-acre lease near Blue Goose mine at Cardin, where 23 drill holes showed ore

at 260 ft. Two shafts put down and drifts from both now in ore. T. J. Rightly, of Miami, superintendent.

Northern Arkansas

C. F. MOSBAUGH (Rush)—Opening up promising mine on 135-acre tract short distance from Rush. Mosbaugh has been blind for more than 20 years; operated in Joplin section until last spring.

MONTANA

Beaverhead County

JACK RABBIT (Argenta)—Vein of high-grade copper ore was uncovered at this mine; said to be 14 in. wide, carrying 15% copper, from 20 to 30 oz. in silver and from $1 to $4 in gold. Expect to begin shipping ore within a few weeks.

Jefferson County

ELKHORN QUEEN (Elkhorn)—Steam hoist and boiler being overhauled by John Lynn and associates, who have leased property.

ELKHORN BULWER (Elkhorn)—Crosscut being run on 200-ft. level to cut high-grade copper shoot, on which winze was sunk last spring.

Mineral County

TARBOX (Saltese)—Work of equipping mine nearing completion. Concentrator for handling low-grade ores is to be erected in spring.

Silver Bow County

BUTTE & SUPERIOR (Butte)—November zinc production estimated at 15,000,000 lb. Mill to be extended, following favorable decision in patent litigation.

ANACONDA (Butte)—At the Emma mine, the deep crosscut from the Gagnon workings has reached a point about 800 ft. below the Emma shaft. Both raising and sinking will be prosecuted and stations are to be cut every 200 ft. Estimated that shaft will be completed by May.

TUOLUMNE (Butte)—At company's Spread Delight claim, in the Main Range group in the eastern section, a 20-ft. vein was cut 625 ft. south of Sinbad shaft. Samples have assayed 4% copper with 3 oz. silver. Preparatory work at Colusa Leonard Extension in same district is progressing rapidly; shaft sinking will be started Jan. 1. At company's property, on Anaconda Hill, 140 tons of ore are being produced daily; November output will show an increase of 50% over October.

NEVADA

Elko County

NEW TUSCARORA MINING (Tuscarora)—Company has purchased four Primeaux claims, on which leasers did well until water became excessive. Drainage and development tunnel now in about 325 ft. Practically virgin ground.

Esmeralda County

BLACK BUTTE (Goldfield)—Recent shipment from the Campbell lease gave returns of about $200 per ton.

SILVER PICK EXTENSION (Goldfield)—Recently organized to take over six claims adjoining the Silver Pick on the north and west.

SILVER PICK (Goldfield)—Station cut near 1,100-ft. point in shaft and a west crosscut is being driven to encounter veins disclosed by recent core drilling.

REORGANIZED CRACKER JACK (Goldfield)—Shaft retimbered to 320-ft. level and east crosscut being driven to encounter vein on dip, now out about 175.

JUMBO EXTENSION (Goldfield)—In addition to present lateral-development program, company contemplates core-drilling below bottom levels of mine.

GOLDFIELD CONSOLIDATED (Goldfield)—Final report for October shows net realization $17,045 from treatment of 30,000 tons ore. Total operating costs were $4.88 and net costs $4.78 per ton. Development work amounted to 1,896 ft. and cost $5.665 per ft. Mohawk shaft abandoned, the territory being served by electric haulage to the Combination and Clermont shafts.

Humboldt County

HUMBOLDT COUNTY TUNGSTEN MINES CO. (Lovelock)—New mill at Toulon running smoothly; practically all construction completed. Output contracted to Eastern firm.

Nye County

TONOPAH MINE WAGES increased 50c. per day by the Tonopah Mine Operators' Association; effective so long as silver maintains a monthly average price of over 70c. per oz.

TONOPAH EXTENSION (Tonopah)—October profit, $50,251 from treatment of 10,038 dry tons. Bullion production, 153,317 oz. silver and 1,488.12 oz. gold.

TONOPAH ORE PRODUCTION for week ended Nov. 25 was 10,442 tons valued at $203,896, compared with 9,579 tons for week previous. Producers were: Tonopah Belmont, 2,999 tons; Tonopah Mining, 2,750; Tonopah Extension, 2,380; Jim Butler, 1,050; West End, 687; Halifax, 210; Rescue-Eula, 188; McNamara, 52; miscellaneous, 126 tons.

White Pine County

NEVADA CONSOLIDATED (McGill)—October copper output 8,676,327 lb., a gain of 316,147 lb. over September and a new high record. Last year, production was 5,880,083 lb. in October.

NEW MEXICO

CHINO (Santa Rita)—October copper production, 6,921,081 lb., a reduction of 476,123 lb. from the September output. Last year, produced 6,319,194 lb. in October.

TENNESSEE

TENNESSEE COPPER CO. (Copperhill)—Control passed Nov. 28 to Tennessee Copper and Chemical Corporation, formed with 400,000 shares, to re-establish the standing of the old company and to furnish it with working capital. Adolph Lewisohn succeeds Utley Wedge as president of the Tennessee Copper Co.; Sam A. Lewisohn will be vice-president, and E. H. Westlake, secretary and treasurer. The new board will comprise these officers and other directors as follows: S. S. Rosenstamm, J. H. Susmann, J. Parke Channing, J. S. Bache, H. M. Kilborn, Richard Sutro, W. B. Joyce, Martin Vogel.

UTAH

Juab County

LOWER MAMMOTH (Mammoth)—Lead-silver ore as well as copper being mined; shipments coming from 1,000, 1,400 and 1,500 levels.

YANKEE (Eureka)—Eighteen inches of ore running high in silver recently opened; followed about 30 ft.; more lead appearing in the ore.

TINTIC OUTPUT for first 11 months of 1916 amounted to 8,522 cars or about 400,000 tons. November shipments were 884 cars, estimated at 44,200 tons; in October 788 cars were shipped.

TINTIC STANDARD (Eureka)—Progress of 5 ft. daily in shaft sinking with small hoist. With new equipment—expected by Dec. 9—it is hoped to make 8 ft. daily. November shipments, about 12 cars.

COLORADO (Silver City)—Contract given to Walter Fitch, Jr., to sink shaft from 1,500- to 2,000-ft. level. While this work is being done the large fissure on the 1,500 will be prospected. Property adjoins Iron Blossom on north.

EAGLE & BLUE BELL (Eureka)—Shipped in November 36 cars; 34 cars in October. Water encountered in main shaft at 2,018 ft., about 30 ft. higher than expected. Work discontinued here for present and development of new orebodies undertaken. Elevation of collar of shaft is 6,816 ft. above sea level. Elevation of Chief Consolidated approximately 6,665 ft., and water encountered at 1,790. Other properties opened to water level and below are Gemini, Centennial-Eureka and Grand Central.

Salt Lake County

MICHIGAN-UTAH (Alta)—Development being done on new oreshoot in Lavinia fissure.

SELLS (Alta)—Ore being mined from development, and two cars awaiting shipment. Last lot brought $43 per ton net smelter returns.

SOUTH HECLA (Alta)—Slightly increased shipments possible owing to somewhat improved condition of roads. Between 150 and 175 tons shipped weekly.

ALBION (Alta)—Work in Quincy tunnel following vein carrying copper, and a little silver and gold. Two cars awaiting transportation to smeltery.

ALTA CONSOLIDATED (Alta)—Negotiations under way with Michigan-Utah, for use during night of that company's aërial tram line to Tanners Flat. New winze sunk in ore 60 ft. below tunnel level.

Summit County

BIG FOUR EXPLORATION (Park City)—Company's mill at Atkinson treating up to 1,000 tons of tailings daily.

SILVER KING COALITION (Park City)—November shipments were 2,046 tons of ore and concentrates; in October 1,878 tons.

SILVER KING CONSOLIDATED (Park City)—Tramway handling 50 tons of ore daily. Thaynes Cañon tunnel in 1,100 ft. Two shifts working.

THREE KINGS (Park City)—Rock carrying 5 to 6 oz. silver encountered in winze sunk 125 ft. below 500. Country rock is siliceous gray limestone and is mineralized with pyrite.

PARK CITY SHIPMENTS for November—according to preliminary figures—were 7,777 tons of ore and concentrates by 11 shippers. In October 6,350 tons were shipped, and in September 8,300 tons.

GRASSELLI CHEMICAL (Park City)—Recently opened offices in Salt Lake City, 1108 Newhouse Building. Purposes purchase of zinc ores, and investigation and development of zinc properties. Offices in charge of George H. Short, who has represented the company for some time in Park City.

Tooele County

IN DUGWAY DISTRICT, Mines Development Co., of Salt Lake City, has leased the Golconda and Bullion Hill properties and will use motor trucks for hauling ore to Lund on the Salt Lake Route. The Belcher mine has been leased by Salt Lake interests including W. F. Snyder, B. L. Cutler and O. Keeler. Other active properties are the Silver Bell and the Horn Silver, and work is to be resumed soon at the Black Maria and Rattler groups.

WISCONSIN

Zinc-Lead District

TIFFANY ZINC (Platteville)—New 200-ton mill at Potosi completed.

VINEGAR HILL (Platteville)—Completed the Yewdall mill at Livingston and the Meloy mill at New Diggings, each handling 150 to 200 tons of ore in 10 hr. Mill construction started on Jefferson property at Hazel Green.

WISCONSIN ZINC (Platteville,)—Three concentrating mills will be erected; the Champion-Church at New Diggings, the Copeland at Shullsburg and the Tom Calvert at Benton; the East End, Federal, Empire and La Fayette mills have been dismantled, the machinery and lumber of which will be used in constructing the new plants. A large warehouse is under construction at the Champion mine, also a wet concentrating plant at the Skinner roaster to wash the low-grade fines from the roaster. This company, together with the Mineral Point Zinc Co., Vinegar Hill Zinc Co. and others will build a spur 1.8 mi. long, with 630 ft. of tunnel, to connect the New Diggings camp with the Chicago & Northwestern Ry. at Strawbridge.

CANADA

British Columbia

PLATINUM is being recovered from placer workings on Tulameen River, one miner having secured 20 oz.

U. S. ORE SHIPMENTS TO TRAIL smeltery so far this year amount to 31,673 tons coming from 29 properties, mainly in Washington and Idaho.

CHAMBERS GROUP (Slocan)—J. Y. Kressler, one of the original locators of the Ruth mine, has taken a three-years' bond on this property east of the Noble Five mill.

Ontario

LALLY (Porcupine)—Asking tenders for approximately 4,000 ft. of diamond drilling.

AURUM (Munro)—On this property, formerly known as the Smith-Curry adjoining the Cræsus, encountered 4-ft. vein showing free gold.

TRETHEWEY (Cobalt)—Taking out good ore from old Rochester mine, worked under lease. Vein 1 in. wide on 290-ft. level carries some 2,000-oz. ore.

WEST DOME (Porcupine)—The 12-drill compressor is now being run by 100-hp. motor. New hoist is in place and the new shaft is down 30 ft. Crosscut being run from old shaft on 300-ft. level to connect with it.

PORCUPINE CROWN (Timmins)—New 200-ton crusher installed. Diamond drilling under way from 500-ft. level to cut at 1,000 ft. several veins paralleling vein now being developed at 800- and 900-ft. levels.

HOLLINGER CONSOLIDATED (Timmins)—During four weeks ended Nov. 3 gross profits were $241,591 from 49,956 tons of ore; average value of $8.62; working cost $3.64 per ton milled. Mill ran 93.3% of possible time. The total deficit to date resulting from increased dividends required by the merger is $238,148. Liability to the shareholders of the Acme, Millerton and Canadian Mining and Finance Co. under conditions of merger amounting to $720,000, is to be met by an issue of 120,000 shares of treasury stock at $6.50 per share, which is offered to shareholders in proportion of one share for every 40 held by them.

OPHIR (Cobalt)—Seven veins have been cut within 20 ft. in crosscut from bottom of shaft. Three of them converged into vein 14 in. wide.

MEXICO

BOLEO (Santa Rosalia, Baja Calif.)—October copper production 984 metric tons.

SANTA GERTRUDIS (Pachuca, Hidalgo)—In October milled 14,823 tons; loss, £960. Owing to shortage of supplies, could only operate at half capacity.

EXPLORATION CO., LTD. (24 Lombard St., London, Eng.)—This company, heavily interested in El Oro, Mexico Mines of El Oro, Buena Tierra and other companies, has reduced its capitalization from £750,000 to £375,000 on account of depreciation of its Mexican investments.

COLOMBIA

DREDGING CONSOLIDATION effected of Western placer properties of Anglo-Colombian Development Co. and of the Henry G. Granger properties, controlled by Adolph Lewisohn interests, which it is understood will assume the management.

GREAT BRITAIN

THE MOELWYN BLENDE MINES, at Festiniog, in northern Wales, have been reopened by the Zinc Mines of Great Britain, Ltd.

GERMANY

ALUMINUM WORKS, according to a wireless report from Berlin, are to be erected "by a Bavarian syndicate; capacity to be 6,000 tons per annum, or about one-third the German requirements."

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—Cable estimate, November cleanup $135,865. Final October results from 27,569 tons were $121,218. Bullion party left on Nov. 4, composed of five white men, company's Japanese secretary and five governmental police officers, mounted on excellent Manchurian ponies, lately purchased especially for bullion trips.

The Market Report

Metal Markets

NEW YORK—Dec. 6, 1916

Copper and lead were both conspicuously strong and advanced on relatively small business. Spelter was weak, declining sharply on small business.

Copper, Tin, Lead and Zinc

Copper—The volume of business was small, not so much owing to absence of buyers as to the inability of producers to supply any more copper previous to the middle of 1917. There are still manufacturers who are willing to buy at current prices if they can get the copper. On the other hand, there are manufacturers who need the copper but are willing to wait and take their chances on the market becoming easier.

The chief business during the last week was for second-quarter delivery and was done at advancing prices. Sales of prompt copper were made as high as 35½c., r.t., while first-quarter business was done at 34c. r.t. At the close the position of the market was about as follows: Prompt, 35@35½c.; first-quarter, 34@34½c.; second-quarter, 33½c.; all regular terms.

Some business was reported done for second half of 1917 at relatively low prices, 30@31c., etc., but such transactions were only sporadic.

Copper Sheets—Base price for copper sheets remains at 42c. for hot rolled and 43 for cold rolled, as reported last week. Wire is on a base of 37c., f.o.b. mill.

Tin—This market was very quiet. At the opening, prompt was 45c. and futures, 43¾c.; at the close, the quotations were 44c. and 43c., respectively.

Lead—The chief feature of the last week was the advance by the A. S. & R. Co. to 7¼c. on Tuesday morning, and the announcement of a further advance to 7½c. an hour or so later. The simple explanation of these events, which have been regarded as somewhat mysterious, is that the advance to 7¼c. was decided on the previous afternoon, and the second advance was rather in the nature of a change of mind. Although lead had previously been advancing in the outside market and continued to do so, the amount of business done by producers was not very large and was decidedly less than in the previous week. In some quarters producers are so completely sold that they have nothing further to offer for early delivery, but that is probably not the case in all quarters. There are suspicions, moreover, that supplies of prompt lead are held speculatively and that the market is being boosted by speculative influences.

Spelter—Right from the beginning of the week this market declined sharply on offerings by second hands. Most producers stood quite aloof and continued to ask higher prices, but some of them met the market on such small orders as could be obtained. About Dec. 5 there began to be offerings by first hands—small producers—as well as second hands, and considerably lower prices were indicated as being acceptable. The decline occurred in a dull market and the total volume of business transacted was light. Brass makers were only small buyers and galvanizers were conspicuous by their absence. Europe exhibited no interest whatever, prices over there being below our parity. The opinion is expressed that stocks of spelter in the hands of speculators are larger than was supposed.

Zinc Sheets—The price of zinc sheets remains based on $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount, as reported last week.

Other Metals

Antimony—Market steady at 14½c., with fair business done. December-January shipment from China is quoted at 13½c., c.i.f., New York, duty unpaid.

Quicksilver—Price advanced to $80. San Francisco reports, by telegraph, $78, firm.

Nickel—The price of nickel remains unchanged at 45@50c. per lb., electrolytic commanding a premium of 5c. per lb.

Aluminum—Quotations are at 64@65c. per lb. for No. 1 ingots at New York.

Gold, Silver and Platinum

NEW YORK—Dec. 6

Gold—The sum of $8,100,000 in gold imported from Canada was deposited at the New York assay office by J. P. Morgan & Co. A large amount of gold, said to be about $35,000,000, was shipped from San Francisco last week, destined for the Morgan firm in New York. It was sent by the Russian government. According to report of Samuel Montagu & Co., London, Nov. 23, the Bank of England reserve of gold against its note issue shows a slight increase of £42,955, as compared with the previous week's returns.

Silver—The latest advices from London indicate a healthy undertone to the market; not merely from European and Indian currency demands, but also from the firmness of the China exchanges. Telegraphic advices from the Far East claim "that a shortage of sycee is being really felt. With a possibility therefore of an inquiring for silver from China the market is expected to show a good tendency." This cable report has been followed by advance of silver to36⅛d.

Report of Samuel Montagu & Co., London, Nov. 23, says that during the preceding week the market had been swept more or less clear of supplies. A further advance in rates became unavoidable, owing to the continued strength of the China exchanges which led to purchases in America and also in London. The quotation advanced daily from 34d., the price on Nov. 17, recording successive rises of ⅛, ¼, ⅜, ¼ and ⅛d.

Inquiry was not confined to mintage alone, but embraced orders for general purposes home and continnetal, and also for the Indian Bazaars. The unfavorable views taken in India have caused a "bear" position to be opened in the London market—a state of affairs, in view of the statistical position, not without danger.

It cannot be challenged that the present condition of the market is more sound than when the spectacular movements in May last carried the quotation to 37⅛. During the intervening period the Chinese stock has been greatly reduced, America has been relieved of certain accumulations she then held, and the Indian Currency figures, notwithstanding very large continuous purchases for the Indian Mints, show a declining tendency. The silver market has often lived up to its reputation of doing the unexpected, but the situation is such that further advances may be expected before the close of the year, provided no new factor intervenes.

Platinum—Declined owing to slackening demand from jewelry trade. We quote $95@105.

Our Petrograd correspondent advises us, under date of Oct. 13, that there has been no notable change in the market for about six weeks. From Ekaterinburg it is reported that the dredges installed this year in the North Ural platinum areas are working successfully. At that time quotations in Petrograd were at $73.50 per oz., and those at Ekaterinburg were at $72.56 per oz.

Zinc and Lead Ore Markets

Platteville, Wis., Dec. 2—Quotations for the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc is $105 for premium ore down to $98 for medium grade. Base price per 2,000-lb. ton for material assaying 80% lead is $90. Shipments for the week ended Dec. 2, 3,531 tons of zinc ore, 179 tons of lead ore, and 654 tons of sulphur ore. For the year to date the figures are: 122,117 tons of zinc ore, 4,188 tons of lead ore and 29,653 tons of sulphur ore. Shipped during the week to separating plants, 2,921 tons of zinc ore.

Joplin, Dec., 2—Price quotations per 2,000 lb.: Blende, high, $107.75; 60% zinc, premium ore $105, medium $102@98, low $95. Calamine per ton, 40% zinc, $60@50. Average selling price, all grades of zinc, $88.56 per ton.

Lead, high price $91.10, base $92@88. Average selling price all grades of lead, $87.54 per ton.

Shipments of the week: Blende, 10,883 tons; calamine, 511 tons; lead, 1,620 tons. Value all ores the week, $1,150,960; 48 weeks, $34,755,140.

The invasion last week of a buyer of lead ore for shipment to Canada set other buyers busy gathering up all stocks, with a large shipment resulting. Zinc prices, showing weakness in midweek, were rallied at the close to last week's quotations, with some holders asking a higher price level. The rally was occasioned by the breaking of an additional turbine of the hydro-electric company, reducing two-thirds of the power supplied by this company for mine operation. No power is being furnished except for pumping, a large number of mills being idle tonight, with serious prospects ahead for an indefinite period. The production is being greatly handicapped, creating a shortage in output that has caused buyers to purchase ore several weeks ahead of the production.

Other Ores

Tungsten Ore—Market active, several hundred tons being reported sold both for domestic and foreign consumption. We quote $18 per unit, both for prompt and forward delivery.

Molybdenum Ore.—Still scarce. Small business reported at $1.75 per lb. MoS_2 contained.

Iron Trade Review

NEW YORK—Dec. 6

General attention is given to the shortage of pig iron, a situation which "Iron Age" says was clearly indicated a year ago when attention was called to the fact that the blast-furnace capacity of the country was not keeping pace with the increase in capacity of steel works.

SILVER AND STERLING EXCHANGE

	Sterling Exchange	Silver			Sterling, Exchange	Silver	
Nov. Dec.		New York, Cents	London, Pence	Nov. Dec.		New York, Cents	London, Pence
30	.....	...	35 11/16	4	4.7550	75	35 11/16
1	4.7563	75 1/8	35 5/8	5	4.7544	75 1/8	36 1/16
2	4.7556	75 1/8	36	6	4.7544	75 1/8	36 1/8

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

	Copper	Tin	Lead		Zinc
Nov. Dec.	Electrolytic	Spot.	N. Y.	St. L.	St. L.
30	.....	...	.....	.....	.....
	32 1/2		7.20	7.10	12 1/2
1	@33	45	@7.30	@7.15	@12 3/4
	32 1/2		7.20	7.10	12 3/4
2	@33	45	@7.30	@7.15	@12 3/4
	32 1/2		7.30	7.15	12 1/2
4	@33 1/4	44 1/4	@7.50	@7.35	@12 3/4
	32 1/2		7.50	7.25	12 3/4
5	@33 1/4	44 1/4	@7.63	@7.50	@12 3/4
	33		7.50	7.38	11 1/4
6	@33 1/4	44	@7.75	@7.63	@12

The above quotations are our appraisal of the average of the major market based on sales as made and reported by producers and agencies; and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

	Copper			Tin		Lead	Zinc
	Standard		Electrolytic				
Nov. Dec.	Spot	3 Mos.		Spot	3 Mos.	Spot	Spot
30	151	143	169	189 1/2	191 1/4	30 1/4	59 1/2
1	151	143	170	190 1/4	192 1/4	30 1/2	59 1/2
2	.....	.....	.....	.....	.....	.....	.....
4	151	142 3/4	170	189 1/4	190 3/4	30 1/2	60
5	152	143	170	188	189 1/2	30 1/2	58 1/2
6	153	144	170	187	189	30 1/2	58

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21¼ cents.

In the last month or two there has been a wild scramble for pig iron. This was probably exaggerated by heavy purchases of steel-making pig iron for export, but the shortage would have developed anyway. Never has there been such a situation as now exists, and it is such as to discourage any prophesy for the future. If the war continues for another year, the prices may reach a point that will make the present ones seem low.

Export inquiries for ship plates are keeping up a steady stream. Practically all the world seems to be coming to the United States for material of this character. Norwegian shipbuilders in person have been applying to Eastern platemakers for large tonnages. They state that up to September they were drawing the major portion of their supplies from Germany, but since the recent controversy over submarine operations between their country and the latter, these shipments have been shut off summarily. They now are appealing to the American mills to help them out.

PITTSBURGH—Dec. 5

Car shortages are as pronounced as ever at the coal mines, coke works and steel mills, and much hardship results. The traffic managers of the various companies are working very hard and shippers are endeavoring to arrange their shipments to the best advantage. The injury is thus minimized and there has been no serious curtailment in iron and steel production owing to the car situation, but there has been some. The weather has been exceptionally favorable for the season of year.

Wrought iron and steel pipe has been advanced two points or about $4 a ton. Black and galvanized sheets are up $5 a ton, to 4.25@4.50c. for black sheets and 6@6.50c. for galvanized. Iron bars have been advanced $5 a ton to 3.25c. As high as 5c. has been bid for ship plates for first half of 1917 delivery. Since Aug. 1 the railroads have bought about 100,000 freight cars, and during this period the market for plates, delivery at mill convenience, has advanced from 2.90c. to 3.50c., but some of the car plates were bought at premium prices, to secure earlier delivery.

Despite sharp price advances all along the line the buying of steel has continued heavy. The Steel Corporation's unfilled obligations increased by 497,000 tons in October and the increase in November may reach 750,000 tons, owing to heavy bookings of car and ship material, as well as of rails, as the mills have been heavier sellers, for 1918 delivery, since the $5 a ton advance of Nov. 15. There has also been heavy contracting for sheets and tin plates for the first half of next year. It is hardly expected that these heavy bookings will continue indefinitely and the tonnage of business on mill books may begin to decrease after this month.

Pig Iron—Several sales of bessemer iron have been made in the past few days at $35, valley, or $2 above the minimum of a week ago, and at least one sale has been made at $36. Basic has sold readily at $30, an advance of $2 in that grade, and $31 is believed to be obtainable now. Foundry has kept pace with basic. We now quote: Bessemer, $35@37; basic, foundry and malleable, $30@32; forge, $29@31, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh. W. P. Snyder & Co. report average prices obtained in November in actual sales at $29.12, valley, for bessemer and $27.229 for basic. Foundry iron, averaged, from quotations, was $25.60, valley, in November.

Steel—There are reports that as high as $62 has been paid for sheet bars for prompt shipment, and $57 or higher has been done for first half 1917. We quote billets at $55@57 and sheet bars at $57@62, with no regular offerings. Forging billets are $75 and rods $65@70.

Iron Ore

Prices of Lake Superior iron ore for 1917 have been established by sales at the highest figures considered in any recent discussion of the matter. The advance of $1.50 a ton over the year's prices is about 50% more than the maximum talked of two or three months ago. The announcement of another general advance of 10% in wages was made by the leading steel companies on Wednesday, Nov. 22, carrying with it a 10% advance in wages of iron miners, and by late afternoon of that day important iron ore interests let it be known that $1.50 rather than $1.30 would represent the step between the furnacemen's iron-ore costs of 1916 and 1917.

Ferroalloys

Ferromanganese—The market is fairly strong but not particularly active. Domestic on contract is $165 and imported $164, prompt lots being $163@165.

Coke

Connellsville—Several sales of furnace coke for spot shipment were made today at $8, as high a price as has been reached on this movement. Shipments are not up to contract requirements, and some furnaces have had to slow down operations. There is some inquiry for first half, on which $4@4.50 will probably be quoted. Interest is arising in second half deliveries, and it is doubted whether operators would accept less than $5, in view of the high prices obtained for pig iron for that delivery. We quote: Spot furnace, $8; contract, $4@4.50; spot foundry, $9@10; contract, $5.50@6.50, per net ton at ovens.

STOCK QUOTATIONS

N. Y. EXCH.†	Dec. 5
Alaska Gold M.	13½
Alaska Juneau	8
Am. Sm. & Ref., com.	117½
Am. Sm. & Ref., pf.	116⅜
Am. Sm. Sec., pf. A	99½
Am. Sm. Sec., pf. B	96½
Am. Zinc	60½
Am. Zinc, pf.	18
Anaconda	99½
Batopilas Min.	1½
Bethlehem Steel	610
Bethlehem Steel, pf.	155
Butte & Superior	71½
Chile Cop.	33⅜
Chino	68⅜
Colo. Fuel & Iron	57½
Crucible Steel	86⅜
Dome Mines	22
Federal M. & S.	16
Federal M. & S., pf.	48
Great Nor., ore ctf.	43⅜
Greene Cananea	52½
Homestake	130
Inspiration Con.	70
International Nickel	48
Kennecott	57
Lackawanna Steel	104
Miami Copper	46⅛
Nat'l Lead, com.	68
National Lead, pf.	113
Nev. Consol.	31
Ontario Min.	6½
Quicksilver	3
Quicksilver, pf.	2
Ray Con.	33⅜
Republic I. & S., com.	88⅛
Republic I. & S. pf.	115½
Sloss-Sheffield	83
Tennessee Copper	24⅛
U. S. Steel, com.	126
U. S. Steel, pf.	121⅛
Utah Copper	126⅛
Va. Iron C. & C.	62½

N. Y. CURB†	Dec. 5
Buffalo Mines	1.10
Butte & N. Y.	2½
Butte C. & Z.	18½
Caledonia	.51
Can. Cop. Corpn.	2½
Cashboy	.06
Cerro de Pasco	42½
Con. Ariz. Sm.	2½
Con. Coppermines	4
Con. Nev.-Utah	.25
Crystal Cop.	⅛
First Nat. Cop.	4½
Florence	.70
Goldfield Con.	.54
Goldfield Merger	.05
Granite	⅜
Hecla Min.	8½
Howe Sound	8
Jerome Verde	1½
Joplin Ore & Spel.	.47
Kerr Lake	4.70
Magma	54
Majestic	.81½
McKinley-Dar-Sa.	.64
Mother Lode	36½
Nevada Hills	.21
N. Y. & Hond.	16½
Nipissing Mines	9½
Oro	‡.03½
Ray Hercules	5½
Rochester Mines	.75
St. Joseph Lead	21½
Standard S. L.	1⅛
Stewart	.31½
Success	.60
Tonopah	6½
Tonopah Ex.	4½
Tribullion	.31½
Troy Arizona	.93
United Zinc	5½
White Knob, pf.	2½
White Oaks	4½
Yukon Gold	2½

SAN FRAN.*	Dec. 5
Alta	.04
Andes	.25
Best & Belcher	.07
Bullion	.02
Caledonia	.32
Challenge Con.	‡.05
Confidence	.13
Cons. Imperial	‡.01
Con. Virginia	.14
Gould & Curry	.03
Hale & Norcross	.13
Jacket-Cr. Pt.	.03
Mexican	.23
Occidental	.65
Ophir	.17
Overman	.03
Savage	.08
Seg Belcher	.02
Sierra Nevada	.22
Union Con.	.54
Utah Con.	.01
Belmont	5.00
Jim Butler	.95
MacNamara	.05
Midway	.18
Mont.-Tonopah	.20
North Star	.13
Rescue Eula	.24
West End Con.	.67
Atlanta	.08
Booth	.07
C.O.D. Con.	.02
Comb. Frac.	.04
D'field B.B.	.05
D'field Daisy	‡.05
Jumbo Extension	.29
Round Mountain	.37
Sandstorm Kendall	‡.04
Silver Pick	.27
Argo	.04
Ariz. Central	.08
Big Jim	1.31½
Lazy Boy	.07
Nellie	.29
Tom Reed	1.90
United Eastern	5.00
United Western	.05

BOSTON EXCH.*	Dec. 5
Adventure	5
Ahmeek	118
Algomah	1½
Alloues	77½
Ariz. Com., ctfs.	16½
Bonanza	.25
Butte-Balaklava	2½
Calumet & Ariz.	94½
Calumet & Hecla	600
Centennial	23½
Copper Range	79½
Daly West	3
East Butte	18½
Franklin	11½
Granby	107
Hancock	20½
Hedley	20
Helvetia	.75
Indiana	4½
Island Cr'k, com.	69
Isle Royale	39½
Keweenaw	5
Lake	15½
La Salle	5½
Mason Valley	6½
Mass	17½
Mayflower	3½
Michigan	4½
Mohawk	103
New Arcadian	6½
New Idria	16½
North Butte	27½
North Lake	2½
Ojibway	2
Old Colony	43
Old Dominion	79½
Osceola	101
Quincy	97½
St. Mary's M. L.	104
Santa Fe	2½
Shannon	10½
Shattuck-Ariz.	33
So. Lake	6
So. Utah	.28
Superior	18½
Superior & Bost.	7½
Tamarack	45
Trinity	7½
Tuolumne	1½
U. S. Smelting	76½
U. S. Smelt'g, pf.	52
Utah Apex	3½
Utah Con.	22
Utah Metal	7
Victoria	6½
Winona	6½
Wolverine	‡54
Wyandot	2½

BOSTON CURB*	Dec. 5
Alaska Mines Corp.	.90
Bingham Mines	10½
Boston Ely	.70
Boston & Mont.	.75
Butte & Lon'n Dev.	.59
Calaveras	5
Calumet-Corbin	.02
Chief Con.	2½
Cortez	.25
Crown Reserve	.40
Davis-Daly	6⅛
Eagle & Blue Bell	1½
Houghton Copper	2
Iron Cap Cop., pf.	16
Mexican Metals	.51
Mines of America	2
Mojave Tungsten	2½
Nat. Zinc & Lead	.66
Nevada-Douglas	1⅛
New Baltic	3½
New Cornelia	19
Ohio Copper	1
Oneco	.90
Rex Cons.	.60
Rilla	.08
United Verde Ext.	41

SALT LAKE*	Dec. 5
Big Four	1.00
Black Jack	.06
Cardiff	7.00
Colorado Mining	.22
Crown Point	.05
Daly-Judge	8.00
Emma Cop.	1.93½
Empire Copper	1.50
Gold Chain	.17
Grand Central	.59
Iron Blossom	1.57½
Lower Mammoth	.10
May Day	.10½
Opohongo	‡.01½
Prince Con.	1.35
Seven Troughs	‡.03
Silver-King Coal'n	3.20
Silver King Con.	5.00
Sioux Con.	.12½
So. Hecla	1.60
Uncle Sam	.06
Wilbert	.09
Yankee	.21

TORONTO*	Dec. 5
Bailey	.07
Beaver Con.	.45
Chambers Ferland	.24
Coniagas	5.10
La Rose	.55
Peterson Lake	.20
Right of Way	.07
Seneca Superior	‡.09
T. & Hudson Bay	73.00
Temiskaming	.65
Wettlaufer-Lor.	.10½
Dome Exten.	.29
Dome Lake	.65
Foley O'Brien	.70
Hollinger	6.75
Jupiter	.27
McIntyre	1.80
Newray	1.28
Porcu. Crown	.69
Vipond	.42
West Dome	.34

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Dec. 5
Cresson Con.	7.95
Doctor Jack Pot	.11½
Elkton Con.	.10½
El Paso	.40
Findlay	.07
Gold Sovereign	.07½
Golden Cycle	2.65
Granite	.65
Isabella	.23
Mary McKinney	.29
Portland	2.05
Vindicator	1.52

LONDON	Nov. 22
Alaska Mexican	£0 12s 6d
Alaska Tre'dwell	2 17 6
Burma Corp.	3 16 3
Cam & Motor	0 11 0
Camp Bird	0 7 0
El Oro	0 7 6
Esperanza	0 9 6
Mexico Mines	3 15 0
Nechi, pfd.	0 12 0
Oroville	0 16 9
Santa Gert'dis	0 10 6
Tomboy	1 1 3

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York		London			
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	68.515	24.260	23.591	32.584
October	50.654	49.385	67.855	23.199	23.925	32.361
November	49.082	51.714	71.604	22.703	25.094	34.192
Dec.	49.375	54.971		22.900	26.373	
Year	54.811	49.684		25.314	23.675	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York Electrolytic		London Standard		London Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	26.120	68.673	110.283	82.333	126.304
Sept.	17.502	26.855	68.916	113.905	85.250	134.071
Oct.	17.686	27.193	72.601	122.750	88.000	142.523
Nov.	18.627	30.625	77.744	134.659	93.273	155.432
Dec.	20.133		80.773		100.430	
Year	17.275		72.532			

Tin	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	38.830	152.625	171.345
October	33.080	41.241	151.554	179.307
November	39.224	44.109	167.670	186.932
December	38.779		167.000	
Av. year	38.590		163.960	

Lead	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.498
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610	6.810	4.490	6.699	23.151	30.786
October	4.600	7.000	4.499	6.898	23.994	30.716
November	5.155	7.042	5.078	6.945	25.278	30.500
December	5.355		5.266		28.807	
Year	4.673		4.567		22.917	

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	85.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
August	12.781	8.730	12.611	8.560	67.786	51.587
Sept.	13.440	8.990	13.270	8.820	67.841	52.095
Oct.	12.800	9.829	12.596	9.659	66.536	54.159
Nov.	15.962	11.592	15.792	11.422	88.409	56.023
Dec.	15.391		15.221		89.400	
Year	13.230		13.054		67.553	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86	22.88	15.95	19.58	15.70	19.53
October	16.95	24.61	15.96	21.26	15.80	21.51
November	17.57	29.12	16.47	27.23	17.20	25.60
December	19.97		18.44		18.95	
Year	$15.82		$14.76		$14.95	

‡ As reported by W. P. Snyder & Co.